

**GEO-ENVIRONMENTAL & GEOTECHNICAL ASSESSMENT
(GROUND INVESTIGATION)
REPORT**

FOR

**LAND ADJACENT TO 37 BOURNE COURT
STATION APPROACH
RUISLIP
HA4 6SW**



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EXECUTIVE SUMMARY

Clearview Homes commissioned Jomas Associates Ltd to undertake a Geo-environmental and Geotechnical ground investigation at the site Bourne Court, South Ruislip, HA4 6SW.

The principle objectives of the study were as follows:

- To determine the nature and where possible, the extent of contaminants potentially present at the site;
- To establish the presence of significant pollutant linkages, in accordance with the procedures set out within the Environment Agency (EA) report R&D CLR11 and relevant guidance within the National Planning Policy Framework (NPPF);
- To assess whether the site is safe and suitable for the purpose for which it is intended, or can be made so by remedial action; and,
- To obtain geotechnical parameters to inform preliminary foundation design.

It should be noted that the table below is an executive summary of the findings of this report and is for briefing purposes only. Reference should be made to the main report for detailed information and analysis.

Site History and Ground Investigation	
Desk Study Overview	A Desk Study report has been produced for the site and issued separately. A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information. A review of historical maps indicates that on the earliest available maps (1865) the site was vacant, possibly used as agricultural land. The first development is shown on the 1935 map when a building labelled as a school is shown in the south-east corner of the site, with the majority of the site labelled as playing fields. The school is extended prior to 1940, with extensive redevelopment (maintaining school use) shown on the 1960 map; a heap is also shown on site in the north-east corner at this time. By 1976 the site has been redeveloped (including removal of the heap) and holds a hostel, a care centre and an electricity substation in the southern corner. No further changes are shown up to the most recent map dated 1993, although the site is now devoid of structures (excluding an electricity sub-station), all buildings having been demolished prior to the Jomas walkover. The surrounding area has seen a mixture of uses, with predominantly residential development to the south and south-west, and commercial and industrial uses to the north and north-east. Of particular note are unspecified works located 75m south-west, and "Odyssey Business Park" adjacent to the north of the site. The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No superficial or artificial deposits are reported on site or in close proximity to the site. The underlying solid deposits directly underlying the site are identified as an Unproductive aquifer. A review of the provided Sitecheck Report indicated that there are no source protection zones within 500m of the site.

Site History and Ground Investigation	
	There are no groundwater, surface water or potable water abstractions reported within 1km of the site. The nearest detailed river entry is reported 279m south west of the site, identified as a Drain. There are no surface water features reported within 250m of the site. There are no Environment Agency Zone 2 or 3 floodplains reported within 250m of the site
Intrusive Investigation	The ground investigation was undertaken on 30 August 2018, and consisted of the following: • 5No. window sampling boreholes, drilled up to 2.45m below ground level (bgl), with associated in situ testing and sampling; • California Bearing Ratio in situ testing carried out in each windowless sampling position. • Laboratory analysis for chemical and geotechnical purposes, • 4No. return visits to monitor ground gas concentrations and groundwater levels.
Ground Conditions	The results of the ground investigation revealed a ground profile comprising Made Ground to a maximum depth of 0.9m over the London Clay Formation. During the ground investigation no groundwater was reported. During return site visits undertaken from 06 September 2018 to 26 September 2018, Groundwater was reported at depths of between 1.62mbgl and 3.11 mbgl in WS1, WS3 and WS4.
Environmental Considerations	Following generic risk assessments elevated concentrations of arsenic, benzo(a)pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(123-cd)pyrene and dibenzo(ah)anthracene were detected in soils in excess of generic assessment criteria for the protection of human health within a residential with plant uptake end-use scenario. Asbestos in the form of loose chrysotile fibres were detected in 1No. sample analysed in the laboratory. This was found to be quantified to a level of <0.001% asbestos by weight. In order to mitigate risks to end users of the development, made ground soils should be encapsulated by removal and replacement with 450mm cover layer of clean sub/topsoil in all areas of private soft landscaping, to be placed above a geotextile membrane or marker layer. In areas of public or communal soft landscaping, the topsoil cover layer may be reduced to 300mm. Where made ground is removed and the base of the made ground is encountered at shallower depth than the depth of the proposed clean cover, the depth of clean cover can be limited to the depth of the base of the made ground. Screening of levels of determinands potentially affecting water pipes identified exceedances relating to 2No. bands of hydrocarbons, therefore upgraded pipework may be required. Potable supply pipework details should be confirmed with the relevant utility provider at an early stage of the project life cycle. Water levels reported during monitoring visits may be attributed to surface water ingress. As the site is directly underlain by relatively impermeable deposits of the London Clay Formation, a pathway for contaminant migration to any wider controlled waters receptors is not considered to exist. In addition the identified elevated contaminants are of reported very low mobility, the risks to controlled waters receptors is currently considered to be negligible.

Site History and Ground Investigation	
	The site can be considered as Characteristic Situation 1 in terms of the gas screening value when calculated using worst case results. Therefore formal gas protection methods are not considered necessary. A remediation strategy will be required for the proposed development.
Geotechnical Considerations	Based upon the information obtained to date, as the proposed development are three storey residential buildings with associated penthouse units, the calculated bearing capacity may not be suitable for the proposed structures. Carrying capacities may be increased by widening the strip footings. However a pragmatic approach to site safety and costings suggests that a piled foundation solution within the underlying London Clay Formation should be considered. During the ground investigation no groundwater was reported. Subsequent groundwater monitoring results are indicative of surface water ingress rather than encountered groundwater. Due to the presence of cohesive ground with a high volume change potential, in accordance with NHBC Chapter 4.2 a suspended floor slab will be required. The depth of clear void beneath the suspended floor slab will be dependant on the floor type used. Excavations during the intrusive works, although open for a relatively short period of time remained reasonably stable. It is recommended that the stability of all excavations should be assessed during construction. Attention is also drawn to the provisions of the Health and Safety at Work Regulations, which state that the sides of any excavations greater than 1.2m depth, into which personnel are required to enter, should be fully supported or battered back to a safe angle. Based on the results of chemical testing, the required concrete class for the site within the London Clay Formation is DS-3 assuming an Aggressive Chemical Environment for Concrete classification of AC-3 in accordance with the procedures outlined in BRE Special Digest 1. Within the Made Ground these are DS-2 AC-2 respectively. Interim Advice Note 73/06 Revision 1 Design Guidance for Road Pavement Foundations, suggest that a minimum permitted design CBR of 2.1% is used. Where a subgrade has a lower CBR, it is considered unsuitable support for a pavement foundation. It must therefore be permanently improved.

1 INTRODUCTION

1.1 Terms of Reference

- 1.1.1 Clearview Homes ("The Client") has commissioned Jomas Associates Ltd, to assess the risk of contamination posed by the ground conditions at a site referred to as Bourne Court, South Ruislip, HA4 6SW and to provide indicative recommendations for foundation design prior to the redevelopment of the site.
- 1.1.2 It is understood that the proposed development will involve the construction of 3No residential blocks to provide 69No flats. Communal and private soft landscaping is understood to be proposed.
- 1.1.3 To this end a Desk Study has been produced for the site and issued separately (Jomas, May 2018), followed by an intrusive investigation (detailed in this report).
- 1.1.4 A full list of previous reports undertaken for the site by Jomas are detailed in Table 1.1:

Table 1.1: Previous Reports - Jomas

Title	Author	Reference	Date
Geo-environmental Desk Study / Preliminary Risk Assessment	Jomas Associates Ltd	P1528J1393/sl Final V1.0	31 May 2018

- 1.1.5 The intrusive investigation was undertaken in accordance with Jomas proposal dated 01 June 2018.

1.2 Proposed Development

- 1.2.1 The proposed development is to comprise of the construction of 3No. residential blocks to provide 69No. flats. Communal and private soft landscaping is understood to be proposed.
- 1.2.2 For the purposes of the contamination risk assessment, the proposed development is classified as 'Residential with plant uptake'.
- 1.2.3 A copy of the proposed development plan is presented in Figure 2.
- 1.2.4 For the purpose of geotechnical assessment, it is considered that the project could be classified as a Geotechnical Category (GC) 2 site in accordance with BS EN 1997. GC 2 projects are defined as involving:
- Conventional structures.
 - Quantitative investigation and analysis.
 - Normal risk.
 - No difficult soil and site conditions.
 - No difficult loading conditions.
 - Routine design and construction methods.

1.3 Objectives

1.3.1 The objectives of Jomas' investigation were as follows:

- To conduct an intrusive investigation, to determine the nature and extent of contaminants potentially present at the site;
- To establish the presence of significant pollutant linkages, in accordance with the procedures set out within Part IIA of the Environmental Protection Act 1990, associated statutory guidance and current best practice including the EA report R&D CLR 11; and,
- To obtain geotechnical parameters to inform preliminary foundation design.

1.4 Scope of Works

1.4.1 The following tasks were undertaken to achieve the objectives listed above:

- Intrusive ground investigation to determine shallow ground conditions, and potential for contamination at the site;
- Undertaking of laboratory chemical and geotechnical testing upon samples obtained;
- The compilation of this report, which collects and discusses the above data, and presents an assessment of the site conditions, conclusions and recommendations.

1.5 Supplied Documentation

1.5.1 A number of reports previously prepared by third parties were supplied to Jomas Associates at the commencement of this investigation. Table 1.2 details the documents supplied:

Table 1.2: Supplied Reports

Title	Author	Reference	Date
Sitecheck Assess - Land adjacent to 37 Bourne Court, Station Approach, South Ruislip, HA 4 6SW	Landmark Information	SAS_140379050_1_1	22 nd September 2017
Sitecheck Planning - Land adjacent to 37 Bourne Court, Station Approach, South Ruislip, HA 4 6SW	Landmark Information	PSC_140379050_2_1	22 nd September 2017

1.6 Limitations

1.6.1 Jomas Associates Ltd has prepared this report for the sole use of Clearview Homes, in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas Associates Limited. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

- 1.6.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas Associates Limited has actual knowledge to the contrary, information obtained from public sources or provided to Jomas Associates Limited by site personnel and other information sources, have been assumed to be correct. Jomas Associates Limited does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.
- 1.6.3 Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.
- 1.6.4 Any reports provided to Jomas Associates Limited have been reviewed in good faith. Jomas Associates Limited cannot be held liable for any errors or omissions in these reports, or for any incorrect interpretation contained within them.
- 1.6.5 This investigation and report has been carried out in accordance with the relevant standards and guidance in place at the time of the works. Future changes to these may require a re-assessment of the recommendations made within this report.
- 1.6.6 ***This report is not an engineering design and the figures and calculations contained in the report should be used by the Structural Engineer, taking note that variations may apply, depending on variations in design loading, in techniques used, and in site conditions. Our recommendations should therefore not supersede the Engineer's design.***

2 SITE SETTING

2.1 Site Information

2.1.1 The site location plan is appended to this report in Figure 1.

Table 2.1: Site Information

Name of Site	Land Adjacent to 37 Bourne Court
Address of Site	Station Approach, South Ruislip, Ruislip, HA4 6SW
Approx. National Grid Ref.	510950,185370
Site Area (Approx)	7227m ²
Site Occupation	Vacant
Local Authority	London Borough of Hillingdon
Proposed Site Use	Construction of 3No residential blocks to provide 69No flats. Communal and private soft landscaping is understood to be proposed.

2.2 Desk Study Overview

2.2.1 A Desk Study report has been produced for the site and issued separately (Jomas – May 2018). A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information.

2.2.2 A review of historical maps indicates that on the earliest available maps (1865) the site was vacant, possibly used as agricultural land. The first development is shown on the 1935 map when a building labelled as a school is shown in the south-east corner of the site, with the majority of the site labelled as playing fields. The school is extended prior to the 1940 map edition, with extensive redevelopment (maintaining school use) shown on the 1960 map; a heap is also shown on site in the north-east corner at this time. By 1976 the site has been redeveloped (including removal of the heap) and holds a hostel, a care centre and an electricity substation in the southern corner. No further changes are shown up to the most recent map dated 1993, although the site is now devoid of structures (excluding an electricity sub-station), all buildings having been demolished prior to the Jomas walkover.

2.2.3 The surrounding area has seen a mixture of uses, with predominantly residential development to the south and south-west, and commercial and industrial uses to the north and north-east. Of particular note are unspecified works located 75m south-west, and “Odyssey Business Park” adjacent to the north of the site.

2.2.4 The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation.

2.2.5 No superficial or artificial deposits are reported on site or in close proximity to the site.

2.2.6 The underlying solid deposits directly underlying the site are identified as an Unproductive aquifer.

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- 2.2.7 A review of the provided Sitecheck Report indicated that there are no source protection zones within 500m of the site.
- 2.2.8 There are no groundwater, surface water or potable water abstractions reported within 1km of the site.
- 2.2.9 The nearest detailed river entry is reported 279m south west of the site, identified as a Drain. There are no surface water features reported within 250m of the site.
- 2.2.10 There are no Environment Agency Zone 2 or 3 floodplains reported within 250m of the site
- 2.2.11 The conceptual site model is reproduced in Table 2.2 overleaf.
- 2.2.12 An intrusive investigation was recommended to clarify potential risks to the identified receptors and assess the extent of Made Ground soils present at the site.
- 2.2.13 An asbestos survey and management plan was recommended to identify, remove or manage potential asbestos materials associated with buried services at the site.
- 2.2.14 Soil gas monitoring was to be undertaken due to the potential presence for a significant thickness of Made Ground at the site and the potential for contamination associated with off-site works.

Table 2.2: Preliminary Risk Assessment for the Site

Sources	Pathways (P)	Receptors	Consequence of Impact	Probability of Impact	Risk Estimation	Hazard Assessment
• Potential for Made Ground associated with previous development operations – on site (S1) • Current and previous industrial use - off site works (S2) • Potential asbestos impacted soils from demolition of previous buildings and electrical cable ducts – on site (S3) • Potential PCBs from electricity sub-station – on site (S4)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium	Low	Moderate	GI – Ground Investigation
	• Accumulation and migration of soil gases (P5)		Severe for Asbestos	Low	High for Asbestos	
			Severe	Low	Moderate	
	• Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4)	• Neighbouring site users (R3) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium	Low	Low	

3 GROUND INVESTIGATION

3.1 Rationale for Ground Investigation

- 3.1.1 The site investigation has been undertaken generally in accordance with Contaminated Land Report 11, BS10175, NHBC Standards Chapter 4.1, and other associated Statutory Guidance. If required, further targeted investigations and remedial option appraisal would be dependent on the findings of this site investigation.
- 3.1.2 The soil sampling rationale for the site investigation was developed with reference to EA guidance 'Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination' (Technical Report P5-066/TR).
- 3.1.3 The sampling proposal was designed in order to gather data representative of the site conditions.

3.2 Scope of Ground Investigation

- 3.2.1 The ground investigation was undertaken on 30 August 2018.
- 3.2.2 The exploratory hole location plan is found in Figure 3. Photographic logs are found in Appendix 1.
- 3.2.3 The work was undertaken in accordance with BS5930 'Code of Practice for Site Investigation' and BS10175 'Investigation of Potentially Contaminated Sites'. All works were completed without incident.
- 3.2.4 The investigation focused on collecting data on the following:
- Quality of Made Ground/ natural ground within the site boundaries;
 - Presence of groundwater beneath the site (if any), perched or otherwise;
 - Determination of the presence or absence of hazardous ground gases
 - Obtaining geotechnical parameters to allow initial design to take place.
- 3.2.5 A summary of the fieldwork carried out at the site, with justifications for exploratory hole positions, are offered in Table 3.1 below.

Table 3.1: Scope of Intrusive Investigation

Investigation Type	Number of Exploratory Holes Achieved	Exploratory Hole Designation	Depth Achieved (m BGL)	Justification
Window Sample Boreholes	5	WS1 – WS5	Up to 5.45m bgl	Obtain shallow samples for laboratory contamination and geotechnical testing. To allow in-situ geotechnical testing.
Monitoring Wells	3	WS1, WS3 and WS4	Up to 4.45mbgl	Combined soil gas and groundwater monitoring wells.

3.2.6 The exploratory holes were completed to allow soil samples to be taken in the areas of interest identified in Table 3.1 above. In all cases, all holes were logged in accordance with BS5930:2015.

3.2.7 The exploratory hole records are included in Appendix 2.

3.2.8 Where monitoring well installations were not installed, the exploratory holes were backfilled with the arisings (in the reverse order in which they were drilled) and the ground surface was reinstated so that no depression was left.

3.3 In-situ Geotechnical Testing

3.3.1 In-situ geotechnical testing included Standard Penetration Tests. The determined 'N' values have been used to determine the relative density of granular materials and have been used with standard correlations to infer various other derived geotechnical parameters including the undrained shear strength of the cohesive strata. The results of the individual tests are on the appropriate exploratory hole logs in Appendix 2.

3.3.2 In-situ California Bearing Ratio (CBRs) were determined across the site using the dynamic probe methodology using a Perth Penetrometer Probe and the methodology laid out in IAN 73/06. Copies of the results and calculations are provided in Appendix 6.

3.4 Sampling Rationale

3.4.1 Our soil sampling rationale for the site investigation was developed with reference to EA guidance 'Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination' (Technical Report P5-066/TR).

3.4.2 The exploratory holes were positioned by applying a combined non-targeted sampling strategy, as well as sample locations positioned with reference to sources identified from the desk study.

3.4.3 Soil samples were taken from across the site at various depths as shown in the exploratory hole logs.

3.4.4 Jomas Associates Limited's engineers normally collect samples at appropriate depths based on field observations such as:

- appearance, colour and odour of the strata and other materials, and changes in these;
- the presence or otherwise of sub-surface features such as pipework, tanks, foundations and walls; and,
- areas of obvious damage, e.g. to the building fabric.

3.4.5 A number of the samples were taken from the top 0-1m to aid in the assessment of the pollutant linkages identified at the site. In addition, some deeper samples were taken to aid in the interpretation of fate and transport of any contamination identified.

3.4.6 Soil samples were taken from across the site at various depths as shown in the exploratory hole logs (copies of which are provided in Appendix 2). The methodology used and type of samples taken were chosen to allow the Sampling category to be A or B according to EN ISO 22475-1. This in turn allows suitable geotechnical testing to be carried out.

3.4.7 Groundwater strikes noted during drilling, are recorded within the exploratory hole records in Appendix 2.

3.4.8 Samples were stored in cool boxes (<4°C) and preserved in accordance with laboratory guidance.

3.5 Sampling Limitations

3.5.1 All boreholes were drilled to their proposed depths.

3.6 Laboratory Analysis

3.6.1 A programme of laboratory testing, scheduled by Jomas Associates Limited, was carried out on selected samples of Made Ground and natural strata.

Chemical Testing

3.6.2 Soil samples were submitted to i2 Analytical (a UKAS and MCerts accredited laboratory), for analysis.

3.6.3 The samples were analysed for a wide range of contaminants as shown in Table 3.2 below:

Table 3.2: Chemical Tests Scheduled

Test Suite	No. of tests	
	Made Ground / Topsoil	Natural
Basic Suite (S3)	5	0
Basic Suite (S5)	1	0
Total Organic Carbon	4	0
Water Soluble Sulphate	0	3
TPHCWG (inc BTEX)	1	0
VOCs	1	0
PCBs	1	0
Asbestos Screen & ID	5	0
Asbestos Quantification	1	0

3.6.4 The determinands contained in the basic suite are as detailed in Table 3.3 below:

Table 3.3: Basic Suite of Determinands

DETERMINAND	LIMIT OF DETECTION (mg/kg)	UKAS ACCREDITATION	TECHNIQUE
Arsenic	1	Y (MCERTS)	ICPMS
Cadmium	0.2	Y (MCERTS)	ICPMS
Chromium	1	Y (MCERTS)	ICPMS
Chromium (Hexavalent)	4	Y (MCERTS)	Colorimetry
Lead	1	Y (MCERTS)	ICPMS
Mercury	0.3	Y (MCERTS)	ICPMS
Nickel	1	Y (MCERTS)	ICPMS
Selenium	1	Y (MCERTS)	ICPMS
Copper	1	Y (MCERTS)	ICPMS
Zinc	1	Y (MCERTS)	ICPMS
Boron (Water Soluble)	0.2	Y (MCERTS)	ICPMS
pH Value	0.1 units	Y (MCERTS)	Electrometric
Sulphate (Water Soluble)	0.0125g/l	Y (MCERTS)	Ion Chromatography
Total Cyanide	1	Y (MCERTS)	Colorimetry
Speciated/Total PAH	0.05/0.80	Y (MCERTS)	GCFID
Phenols	1	Y (MCERTS)	HPLC
Total Petroleum Hydrocarbons (banded)	-	N Y (MCERTS)	Gas Chromatography

3.6.5 To support the selection of appropriate tier 1 screening values, 4No. samples were analysed for total organic carbon.

Laboratory test results are summarised in Section 6, with raw laboratory data included in Appendix 3.

Geotechnical Laboratory Testing

3.6.6 In addition to the contamination assessment, soil samples were submitted to the UKAS Accredited laboratory of i2 Analytical Ltd. for a series of analyses.

3.6.7 This testing was specifically designed to:

- to classify the samples; and
- to obtain parameters (either directly or sufficient to allow relevant correlations to be used) relevant to the technical objectives of the investigation.

3.6.8 The following laboratory geotechnical testing (as summarised in Table 3.4) was carried out:

Table 3.4 Laboratory Geotechnical Analysis

BS 1377 (1990) Test Number	Test Description	Number of tests
Part 2		
3.2	Moisture Content Determination	7
4.3 and 5.3	Liquid and Plastic Limit Determination (Atterberg Limits)	7

- 3.6.9 The water soluble sulphate and pH results obtained as part of the chemical analysis were used in combination with BRE Special Digest 1 to allow buried concrete to be classified.
- 3.6.10 The results of the geotechnical laboratory testing are presented as Appendix 4 and discussed in Section 9 of this report.

4 GROUND CONDITIONS

4.1 Soil

- 4.1.1 Ground conditions were logged in accordance with the requirements of BS5930:2015. Detailed exploratory hole logs are provided in Appendix 2. The ground conditions encountered are summarised in Table 4.1 below, based on the strata observed during the investigation.

Table 4.1: Ground Conditions Encountered

Stratum and Description	Encountered from (m bgl)	Base of strata (m bgl)	Thickness range (m)
Dark brown-black/green grey clayey/gravelly sand/silty/sandy gravelly clay/with roots and rootlets. Gravel consists of fine to coarse angular to sub-rounded flint, brick/wood chippings and concrete. (MADE GROUND).	0.0	0.2 – 0.9	0.2 – 0.9
Red/brown/black/orange brown/ with grey patches/ sandy gravelly CLAY. Gravel consists of fine to coarse angular to sub-angular claystone/flint. Contains infrequent/frequent selentie crystals. (LONDON CLAY FORMATION)	0.2 – 0.9	>4.45 – >5.45	>3.55 - >4.65

- 4.1.2 Given the likely ground strata profile identified in the Desk Study and the BGS descriptions of the materials given in Section 3 of the Desk Study it is considered that the encountered strata represent Made Ground overlying the London Clay Formation.

4.2 Hydrogeology

- 4.2.1 No groundwater was reported during the drilling process. Groundwater observed during monitoring are summarised below.

Table 4.2: Groundwater Monitoring Records

Exploratory Hole ID	Depth Encountered (m bgl)	Depth to Base of Well (m bgl)	Stratum
WS1	1.62 – 2.95	3.85	London Clay Formation
WS3	1.89 – 3.11	3.80	London Clay Formation
WS4	1.68 – 2.10	3.89	London Clay Formation

4.3 Physical and Olfactory Evidence of Contamination

- 4.3.1 Black staining of Made Ground noted in WS1 between 0.0m bgl and 0.3m bgl, and WS2 between 0.0 and 0.2m bgl with black colouration noted in the sandy Clay strata of WS4 between 0.6m and 0.9m bgl.
- 4.3.2 Slight organic odours were noted in WS1 between 0.3m bgl and 0.9m bgl and WS4 between 0.6m and 0.9m bgl.

5 RISK ASSESSMENT – ANALYTICAL FRAMEWORK

5.1 Context and Objectives

- 5.1.1 This section seeks to evaluate the level of risk pertaining to human health and the environment which may result from both the existing use and proposed future use of the site. It makes use of the site investigation findings, as described in the previous sections, to evaluate further the potential pollutant linkages identified in the desk study. A combination of qualitative and quantitative techniques is used, as described below.
- 5.1.2 The purpose of generic quantitative risk assessment is to compare concentrations of contaminants found on site against screening level generic assessment criteria (GAC) to establish whether there are actual or potential unacceptable risks. It also determines whether further detailed assessment is required. The approaches detailed all broadly fit within a tiered assessment structure in line with the framework set out in the Department of Environment, Food and Rural Affairs (DEFRA), EA and Institute for Environment and Health Publication, Guidelines for Environmental Risk Assessment and Management.
- 5.1.3 It should be noted that the statistical tests carried out in this report in accordance with CL:AIRE and CIEH (2008) recommendations, are for guidance purposes only and the conclusions of this report should be approved by the local authority prior to any redevelopment works being undertaken.

5.2 Analytical Framework – Soils

- 5.2.1 There is no single methodology that covers all the various aspects of the assessment of potentially contaminated land and groundwater. Therefore, the analytical framework adopted for this investigation is made up of a number of procedures, which are outlined below. All of these are based on a Risk Assessment methodology centred on the identification and analysis of Source – Pathway – Receptor linkages.
- 5.2.2 The CLEA model provides a methodology for quantitative assessment of the long term risks posed to human health by exposure to contaminated soils. Toxicological data have been used to calculate Soil Guideline Values (SGV) for individual contaminants, based on the proposed site use; these represent minimal risk concentrations and may be used as screening values.
- 5.2.3 In the absence of any published SGVs for certain substances, or where the assumptions made in generating the SGVs do not apply to the site, Jomas Associates Limited have obtained Tier 1 screening values for initial assessment of the soil, based on available current UK guidance including the LQM/CIEH S4ULs and DEFRA C4SL. Site-specific assessments are undertaken wherever possible and/or applicable. All assessments are carried out in accordance with the CLEA protocol.
- 5.2.4 CLEA requires a statistical treatment of the test results to take into account the normal variations in concentration of potential contaminants in the soil and allow comparisons to be made with published guidance.
- 5.2.5 The assessment criteria used for the screening of determinands within soils are identified within Table 5.1.

Table 5.1: Selected Assessment Criteria – Contaminants in Soils

Substance Group	Determinand(s)	Assessment Criteria Selected
<i><u>Organic Substances</u></i>		
Non-halogenated Hydrocarbons	Total Petroleum Hydrocarbons (TPHCWG banded)	S4UL
	Total Phenols	S4UL
Polycyclic Aromatic Hydrocarbons (PAH-16)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(ghi)perylene	S4UL
Volatile Organic Compounds (VOCs/sVOCs).	Toluene, Ethylbenzene, Benzene, Xylenes	S4UL
<i><u>Inorganic Substances</u></i>		
Heavy Metals and Metalloids	Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, Copper, Zinc	S4UL
	Copper, Zinc, Nickel	BS: 3882 (2015).
Cyanides	Free Cyanide	CLEA v1.06
Sulphates	Water Soluble Sulphate	BRE Special Digest 1:2005

5.2.6 As the published reports only offer the option of selecting a SOM value of 1%, 2.5% or 6%, a SOM value of 1% has been used for the selection of generic assessment criteria, as 2.05% was the mean value obtained from laboratory analysis. A value of 1% has been assigned as this provides the most conservative estimate for soil guideline values.

5.2.7 It is understood that the site is to be converted to provide residential units with associated communal and private soft landscaping. As a result, the site has been assessed with regards to a residential with plant uptake end use scenario.

5.3 BRE

5.3.1 The BRE Special Digest 1:2005, 'Concrete in Aggressive Ground' is used with soluble sulphate and pH results to assess the aggressive chemical environment of future underground concrete structures at the site.

6 GENERIC QUANTITATIVE RISK ASSESSMENT

6.1 Screening of Soil Chemical Analysis Results – Human Health Risk Assessment

6.1.1 Laboratory analysis for soils are summarised in Tables 6.1 to 6.3. Raw laboratory data is included in Appendix 3.

Table 6.1: Soil Laboratory Analysis Results – Metals, Metalloids, Phenol, Cyanide

Determinand	Unit	No. samples tested	Screening Criteria	Min	Max	No. Exceeding
Arsenic	mg/kg	6	37 S4UL	14	55	1No. WS4 @ 0.5m bgl
Cadmium	mg/kg	6	11 S4UL	<0.2	2.6	0
Chromium	mg/kg	6	910 S4UL	17	210	0
Lead	mg/kg	6	200 C4SL	26	91	0
Mercury	mg/kg	6	40 S4UL	<0.3	<0.3	0
Nickel	mg/kg	6	180 S4UL	17	150	0
Copper	mg/kg	6	2400 S4UL	21	130	0
Zinc	mg/kg	6	3700 S4UL	70	260	0
Total Cyanide ^A	mg/kg	6	33 CLEA v 1.06	<1	<1	0
Selenium	mg/kg	6	250 S4UL	<1.0	2.3	0
Boron Water Soluble	mg/kg	6	290 S4UL	1.4	2.8	0
Phenols	mg/kg	6	120 S4UL	<1.0	<1.0	0

Notes: ^A Generic assessment criteria derived for free inorganic cyanide.

Table 6.2: Soil Laboratory Analysis Results – Polycyclic Aromatic Hydrocarbons (PAHs)

Determinand	Unit	No. Samples Tested	Screening Criteria	Min	Max	No. Exceeding
Naphthalene	mg/kg	6	2.3 S4UL	<0.05	0.29	0
Acenaphthylene	mg/kg	6	170 S4UL	<0.05	1.8	0
Acenaphthene	mg/kg	6	210 S4UL	<0.05	0.52	0
Fluorene	mg/kg	6	170 S4UL	<0.05	0.66	0
Phenanthrene	mg/kg	6	95 S4UL	0.23	8.2	0
Anthracene	mg/kg	6	2400 S4UL	0.11	4.2	0
Fluoranthene	mg/kg	6	280 S4UL	0.59	35	0
Pyrene	mg/kg	6	620 S4UL	0.54	33	0
Benzo(a)anthracene	mg/kg	6	7.2 S4UL	0.5	29	1No. WS1 @ 0.25m bgl
Chrysene	mg/kg	6	15 S4UL	0.45	31	1No.

Determinand	Unit	No. Samples Tested	Screening Criteria	Min	Max	No. Exceeding
						WS1 @ 0.25m bgl
						4No.
Benzo(b)fluoranthene	mg/kg	6	S4UL	2.6	0.58	43
						WS1 @ 0.25m bgl WS1 @ 0.50m bgl WS2 @ 0.15m bgl WS5 @ 0.50m bgl
Benzo(k)fluoranthene	mg/kg	6	S4UL	77	0.35	23
						0
Benzo(a)pyrene	mg/kg	6	S4UL	2.2	0.42	42
						4No. WS1 @ 0.25m bgl WS1 @ 0.50m bgl WS2 @ 0.15m bgl WS5 @ 0.50m bgl
Indeno(123-cd)pyrene	mg/kg	6	S4UL	27	0.44	31
						1No. WS1 @ 0.25m bgl
Dibenzo(ah)anthracene	mg/kg	6	S4UL	0.24	0.23	8.4
						3No. WS1 @ 0.25m bgl WS2 @ 0.15m bgl WS5 @ 0.50m bgl
Benzo(ghi)perylene	mg/kg	6	S4UL	320	<0.05	37
						0
Total PAH	mg/kg	6	-	4.82	329	-

Table 6.3: Soil Laboratory Analysis Results – Total Petroleum Hydrocarbons (TPH)

TPH Band	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeding
C ₈ -C ₁₀	mg/kg	5	S4UL	27	<0.1	<0.1	0
>C ₁₀ -C ₁₂	mg/kg	5	S4UL	74	<2.0	<2.0	0
>C ₁₂ -C ₁₆	mg/kg	5	S4UL	140	<4.0	14	0
>C ₁₆ -C ₂₁	mg/kg	5	S4UL	260	13	77	0
>C ₂₁ -C ₄₀	mg/kg	5	S4UL	1100	100	440	0
Total TPH	mg/kg	5	-	-	<131.1	474.1	-

Note: *The lower value of guidelines for Aromatic/Aliphatics has been selected

Table 6.4: Soil Laboratory Analysis Results – Total Petroleum Hydrocarbons (TPHCWG)

TPH Band	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeding
>C ₅ -C ₆ Aliphatic	mg/kg	1	S4UL	42	<0.01	<0.01	0
>C ₅ -C ₆ Aliphatic	mg/kg	1	S4UL	42	<0.001	<0.001	0
>C ₆ -C ₈ Aliphatic	mg/kg	1	S4UL	100	<0.001	<0.001	0

TPH Band	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeding
>C ₈ -C ₁₀ Aliphatic	mg/kg	1	S4UL	27	<0.001	<0.001	0
>C ₁₀ -C ₁₂ Aliphatic	mg/kg	1	S4UL	130	1.7	1.7	0
>C ₁₂ -C ₁₆ Aliphatic	mg/kg	1	S4UL	1100	12	12	0
>C ₁₆ -C ₃₅ Aliphatic	mg/kg	1	S4UL	65000	42	42	0
>C ₅ -C ₇ Aromatic	mg/kg	1	S4UL	70	<0.001	<0.001	0
>C ₇ -C ₈ Aromatic	mg/kg	1	S4UL	130	<0.001	<0.001	0
>C ₈ -C ₁₀ Aromatic	mg/kg	1	S4UL	34	<0.001	<0.001	0
>C ₁₀ -C ₁₂ Aromatic	mg/kg	1	S4UL	74	<1.0	<1.0	0
>C ₁₂ -C ₁₆ Aromatic	mg/kg	1	S4UL	140	2.4	2.4	0
>C ₁₆ -C ₂₁ Aromatic	mg/kg	1	S4UL	260	96	96	0
>C ₂₁ -C ₃₅ Aromatic	mg/kg	1	S4UL	1100	700	700	0

6.2 Volatile Organic Compounds

6.2.1 In addition to the suites outlined previously, 1No. sample was tested for the presence of volatile organic compounds including BTEX compounds (benzene, toluene, ethylbenzene, xylene).

6.2.2 No VOCs were reported above the laboratory detection limit of 1.0 µg/kg within any tested sample.

6.3 Polychlorinated Biphenyl (PCB) Concentrations

6.3.1 In addition to the suites outlined previously, 1No. samples from the vicinity of the electrical substation were analysed for the presence of PCBs. No PCBs were reported above the laboratory method detection limit of 0.001 µg/kg.

6.4 Asbestos in Soil

6.4.1 5No samples of the Made Ground were screened in the laboratory for the presence of asbestos. The results of the analyses are summarised below in Table 6.5 below

Table 6.5: Asbestos Analysis – Summary

Sample	Screening result.	Quantification result (%)	Comments
WS1 – 0.25m bgl	None Detected	N/A	N/A
WS1 – 0.50m bgl	None Detected	N/A	N/A
WS2 – 0.15m bgl	None Detected	N/A	N/A
WS3 – 0.25m bgl	Detected	<0.001	Chrysotile - Loose Fibres
WS4 – 0.50m bgl	None Detected	N/A	N/A

6.4.2 The results reported an asbestos content of below 0.001%, the fibre content at which arisings are considered hazardous for the purpose of disposal.

6.4.3 A potential pollutant linkage to end users of the proposed developments with regards asbestos in soil is therefore considered to exist.

6.5 Screening of Soil Chemical Analysis Results – Potential Risks to Plant Growth

6.5.1 Zinc, copper and nickel are phytotoxins and could therefore inhibit plant growth in soft landscaped areas. Concentrations measured in soil for these determinands have been compared with the pH dependent values given in BS: 3882 (2015).

6.5.2 Adopting a pH value of greater than 7, as indicated by the results of the laboratory analysis, the following is noted;

Table 6.6: Soil Laboratory Analysis Results – Phytotoxic Determinands

Determinand	Threshold level (mg/kg)	Min (mg/kg)	Max (mg/kg)	No. Exceeding
Zinc	300	70	260	0
Copper	200	21	130	0
Nickel	110	17	150	1No. WS4 @ 0.50m bgl

6.6 Screening for Water Pipes

6.6.1 The results of the analysis have been assessed for potential impact upon water supply pipes. Table 6.7 below summarises the findings of the assessment:

Table 6.7: Screening Guide for Water Pipes

Determinand	No. of tests	Threshold adopted for PE (mg/kg)	Value for site data (mg/kg)		No of Exceedances
			Min	Max	
Total VOCs	1	0.5	<0.001	<0.001	0
BTEX	1	0.1	<0.001	<0.001	0
MTBE	1	0.1	<0.001	<0.001	0
EC5-EC10	6	1	<0.1	<0.1	0
EC10-EC16	6	10	<6.0	17.1	2No. WS1 @ 0.25m bgl WS1 @ 0.50m bgl
EC16-EC40	6	500	125	1098	1No. WS1 @ 0.25m bgl
Naphthalene	6	5	<0.05	0.29	0
Phenols	6	2	<1	<1	0

*Laboratory detection limit

6.6.3 The above suggests that upgraded pipe work may be required.

6.6.4 Alternatively as all of the elevated determinands can be found in lone location, it may be possible to utilise other protection methods including (but not limited to):

- diversion of the pipe,
- localised remediation,

- embedding the pipe in a sufficient thickness of clean granular material.

6.6.5 The water supply pipe requirements for this site should be discussed at an early stage with the relevant utility provider.

6.7 Waste Disposal

6.7.1 The classification of materials for waste disposal purposes was outside the scope of this report. Should quantities of material require off-site disposal, Waste Acceptance Criteria testing will be required.

7 SOIL GAS RISK ASSESSMENT

7.1 Soil Gas Results

7.1.1 Four return monitoring visits have been undertaken from 06 September 2018 to 26 September 2018, to monitor wells installed within boreholes at the site for soil gas concentrations and groundwater levels.

7.1.2 During these visits atmospheric pressure ranged between 1007mb and 1029mb. During these visits pressure trends observed were static and falling.

7.1.3 The results of the monitoring undertaken are summarised in Table 7.1 below, with the monitoring records presented in Appendix 5.

Table 7.1: Summary of Gas Monitoring Data

Hole No.	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	H ₂ S (ppm)	VOCs (ppm)	Peak Flow Rate (l/hr)	Depth to water (mbgl)	Depth of installation (mbgl)
WS1	0.1 – 0.2	0.1 – 3.5	16.1 – 21.2	0	0.0 – 0.7	0.0 – 0.2	1.62 – 2.95	3.85
WS3	0.1 – 0.2	0.1 – 0.4	20.6 – 21.2	0	0.0 – 0.5	0.1 – 0.2	1.89 – 3.11	3.80
WS4	0.1 – 0.2	0.1 – 0.8	20.5 – 21.2	0	0.0 – 0.4	0.0 – 0.2	1.61 – 2.10	3.89

7.2 Screening of Results

7.2.1 As shown in Table 7.1, methane has been reported to a maximum concentration of 0.2% v/v. Carbon dioxide has been reported to a maximum concentration of 3.5% v/v. Screening of the monitoring well headspaces with a photo-ionisation detector (PID) has detected maximum volatile organic compound (VOC) concentration to a maximum level of 0.7 ppm. A maximum flow rate of 0.2l/hr has been reported.

7.2.2 In the assessment of risks posed by hazardous ground gases and selection of appropriate mitigation measures, BS8485 (2015) identifies four types of development, termed Type A to Type D.

7.2.3 Type B buildings are defined as

“ private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels.”

7.2.4 Type B has been adopted as the relevant category for the proposed development.

- 7.2.5 The soil gas assessment method is based on that proposed by Wilson & Card (1999), which was a development of a method proposed in CIRIA publication R149 (CIRIA, 1995). The method uses both gas concentrations and borehole flow rates to define a characteristic situation based on the limiting borehole gas volume flow for methane and carbon dioxide. In both these methods, the limiting borehole gas volume flow is renamed as the Gas Screening Value (GSV).
- 7.2.6 The Gas Screening Value (litres of gas per hour) is calculated by using the following equation

$$\text{GSV} = (\text{Concentration}/100) \times \text{Flow rate}$$

Where concentration is measured in percent (%)
and flow rate is measured in litres per hour (l/hr)

- 7.2.7 The Characteristic Situation is then determined from Table 8.5 of CIRIA C665.
- 7.2.8 To accord with C665, worst case conditions are used in the calculation of GSVs for the site.
- 7.2.9 A worst case flow rate of 0.2l/hr (maximum reported) will be used in the calculation of GSVs for the site. The Characteristic Situation is then determined from Table 8.5 of CIRIA C665.
- 7.2.10 To accord with C665, worst case conditions are used in the calculation of GSVs for the site. These have been summarised below in Table 7.2

Table 7.2: Summary of Gas Monitoring Data

Gas	Concentration (v/v %)	Peak Flow Rate (l/hr)	GSV (l/hr)	Characteristic Situation (after CIRIA C665)
CO ₂	3.5	0.2	0.007	1
CH ₄	0.2	0.2	0.0004	1

- 7.2.11 The methodology set out in BS 8485 (2015) has been used for determining the required gas protection measures. For a Type B development on a CS1 site no formal gas protection measures are considered necessary.
- 7.2.12 BS 8576:2013 has been used to derived threshold levels for carbon monoxide and volatile organic compounds.
- 7.2.13 Given the recorded levels it is not considered that additional protection measures need to be incorporated to protect end users from the recorded carbon monoxide concentrations.
- 7.2.14 PID screening of the monitoring well headspace has revealed maximum concentrations of VOCs of 0.7ppm. As no evidence of potential volatile organic contaminants were identified by the ground investigation, it is considered that the PID screening of monitoring well confirms the assessment that risks to human health receptors via vapour inhalation pathways are low.

8 SUMMARY OF RESULTS

8.1 Land Quality Impact Summary

8.1.1 Following the ground investigation, the following is noted:

- The proposed development is to comprise of the construction of 3No. residential blocks to provide 69No. flats. Communal and private soft landscaping is understood to be proposed.
- Following generic risk assessments elevated concentrations of arsenic, benzo(a)pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(123-cd)pyrene and dibenzo(ah)anthracene were detected in soils in excess of generic assessment criteria for the protection of human health within a residential with plant uptake end-use scenario.
- Asbestos in the form of loose chrysotile fibres were detected in 1No. sample analysed in the laboratory. This was found to be quantified to a level of <0.001% asbestos by weight.
- In order to mitigate risks to end users of the development, made ground soils should be encapsulated by removal and replacement with 450mm cover layer of clean sub/topsoil in all areas of private soft landscaping, to be placed above a geotextile membrane or marker layer. In areas of public or communal soft landscaping, the topsoil cover layer may be reduced to 300mm. Where made ground is removed and the base of the made ground is encountered at shallower depth than the depth of the proposed clean cover, the depth of clean cover can be limited to the depth of the base of the made ground.
- Screening of levels of determinands potentially affecting water pipes identified exceedances relating to 2No. bands of hydrocarbons, therefore upgraded pipework may be required. Potable supply pipework details should be confirmed with the relevant utility provider at an early stage of the project life cycle.
- Water levels reported during monitoring visits may be attributed to surface water ingress. As the site is directly underlain by relatively impermeable deposits of the London Clay Formation, a pathway for contaminant migration to any wider controlled waters receptors is not considered to exist. In addition the identified elevated contaminants are of reported very low mobility, the risks to controlled waters receptors is currently considered to be negligible.
- The site can be considered as Characteristic Situation 1 in terms of the gas screening value when calculated using worst case results. Therefore formal gas protection methods are not considered necessary.
- A remediation strategy will be required for the proposed development.
- As with any ground investigation, the presence of further hotspots between sampling points cannot be ruled out. Should any contamination be

encountered, a suitably qualified environmental consultant should be informed immediately, so that adequate measures may be recommended.

8.1.2 The above conclusions are made subject to approval by the statutory regulatory bodies.

8.2 Review of Pollutant Linkages Following Site Investigation

8.2.1 The site CSM has been revised and updated from that suggested in the desk study in view of the ground investigation data, including soil laboratory analysis results. Table 8.1 highlights whether pollutant linkages identified in the original CSM are still relevant following the risk assessment, or whether pollutant linkages, not previously identified, exist.

SECTION 8 SUMMARY OF RESULTS



Table 8.1: Plausible Pollutants Linkages Summary (Pre Remediation)

Potential Source (from desk study)	Pathway	Receptor	Relevant Pollutant Linkage?	Comment
- Potential for Made Ground associated with previous development operations – on site (S1) - Current and previous industrial use - off site works (S2) - Potential asbestos impacted soils from demolition of previous buildings and electrical cable ducts – on site (S3) - Potential PCBs from electricity sub-station – on site (S4)	- Ingestion and dermal contact with contaminated soil (P1) - Inhalation or contact with potentially contaminated dust and vapours (P2) - Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	- Construction workers (R1) - Maintenance workers (R2) - Neighbouring site users (R3) - Future site users (R4) - Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Y	see 9.1 above for remedial measures. The findings of this report should be included in the construction health and safety file, with adequate measures put in place for the protection of construction and maintenance workers.
	Accumulation and migration of soil gases (P5)		X	Gas Protection measures not considered necessary
	- Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) - Horizontal and vertical migration of contaminants within groundwater (P4)	- Neighbouring site users (R3) - Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Y	Remedial measures required and set out in Section 9.1. Contact should be made with relevant utility providers to confirm if upgraded materials are required. A pollutant linkage to controlled waters is not considered to exist.

9 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

9.1 Ground Investigation Summary

- 9.1.1 No detailed structural engineering design information, with respect to the type of construction and associated structural loadings, was provided at the time of preparing this report. Consequently, a detailed discussion of all the problems that may arise during the proposed redevelopment scheme is beyond the scope of this report.
- 9.1.2 Practical solutions to the difficulties encountered, both prior to, and during construction, are frequently decided by structural constraints or economic factors. For these reasons, this discussion is predominantly confined to remarks of a general nature, which are based on site conditions encountered during the intrusive investigations.
- 9.1.3 It is understood that the proposed development comprises conversion of the existing site to provide commercial office buildings with incorporated car parking and bicycle paths.

9.2 Geotechnical Classification

- 9.2.1 At the Desk Study stage this development was deemed to be a GC2 development in accordance with BS: 1997.
- 9.2.2 The findings of the investigation undertaken and discussed previously do not change this assessment.

9.3 Data Summary

- 9.3.1 The results of the ground investigation revealed a ground profile comprising a variable thickness of Made Ground (up to 0.9m bgl depth), overlying a brown/red/black/orange sandy gravelly Clay with selenite crystals (considered to represent the London Clay Formation), encountered to the base of the boreholes (up to 5.45m bgl).
- 9.3.2 A summary of ground conditions obtained from the ground investigation and the derived geotechnical parameters, is provided in Table 9.1 below.
- 9.3.3 Raw laboratory data is included in Appendix 4.

Table 9.1: Ground Conditions and Derived Geotechnical Parameters

Strata	Depth Encountered (from-to) (mbgl)	SPT 'N' Value	Inferred Shear Strength (kPa)	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (corrected plasticity) (%)	NHBC Volume Change Classification
Dark brown-black/green grey clayey/gravelly sand/silty/sandy gravelly clay/with roots and rootlets. Gravel consists of fine to coarse angular to sub-rounded flint, brick/wood chippings and concrete.	GL to 0.20 - 0.90	-	-	9.8	-	-	-	-
(MADE GROUND).								
Red/brown/black/orange brown/ with grey patches/ sandy gravelly CLAY. Gravel consists of fine to coarse angular to sub-angular claystone/flint. Contains infrequent/frequent selentic crystals.	0.20 - 0.90 To >4.45 – >5.45	5 – 23	23– 104	23 – 30	53 - 71	22 - 31	26 – 40 (24 – 40)	Medium – High
(LONDON CLAY FORMATION)								

9.4 Undrained Shear Strength

9.4.1 Standard Penetration Tests were undertaken at regular intervals throughout the windowless sampler holes.

9.4.2 The N values recorded in the clay increased with depth, this infers that the undrained shear strength of the clay similarly varies.

9.4.3 Figure 9.1 below shows the undrained shear strength inferred by the correlation suggested by Stroud (1974),

$c_u = f_1 \times N$ can be applied,

in which

c_u = mass shear strength (kN)

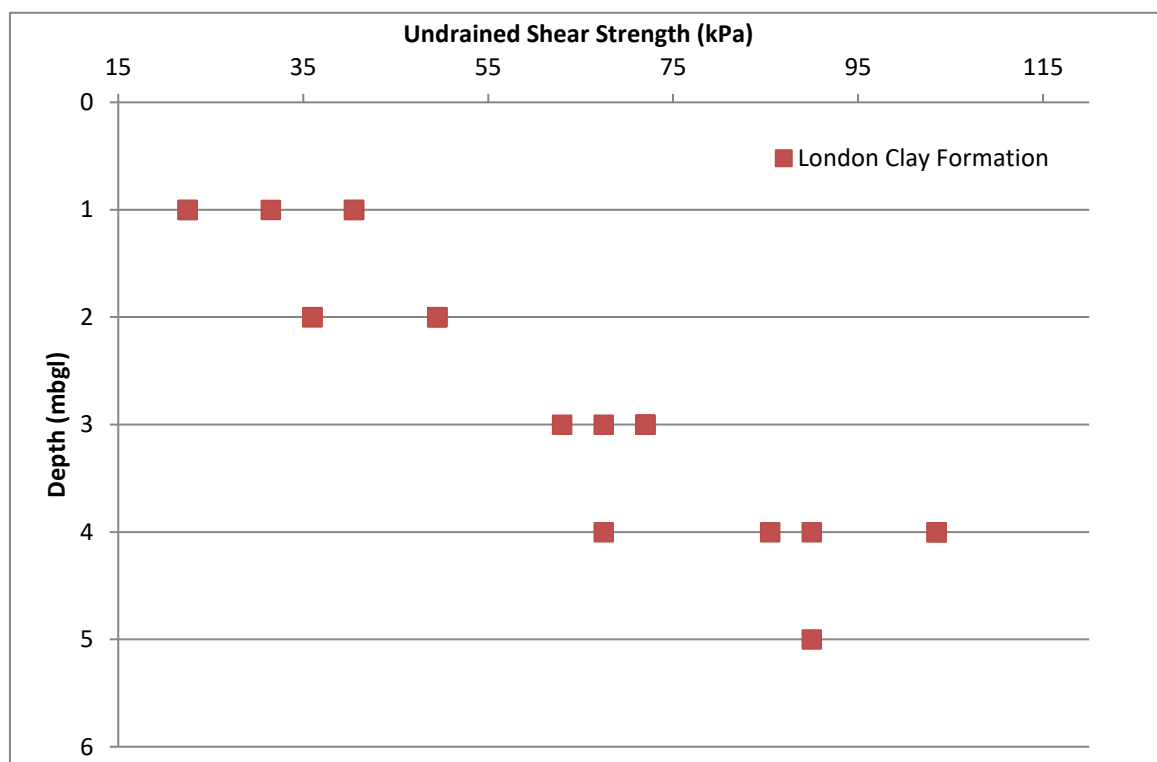
f_1 = constant

N = SPT Value achieved during boring operations

9.4.4 In the above equation f_1 is dependent on the plasticity of the material that the SPT is being carried out in. As the plasticity indices were shown to be greater than 27% a value for f_1 of 4.5 has been adopted after Tomlinson (2001).

9.4.5 The graph below shows the shear strength profile of the London Clay Formation encountered at the site, based on the SPT to shear strength correlation described above.

Figure 9.1: Undrained Shear Strength v Depth



9.5 Coefficient of Compressibility

9.5.1 Stroud and Butler (1974) developed a relationship between the coefficient of compressibility (m_v) and SPT 'N' value.

$m_v = 1 / f_2 \times N$ can be applied,

in which

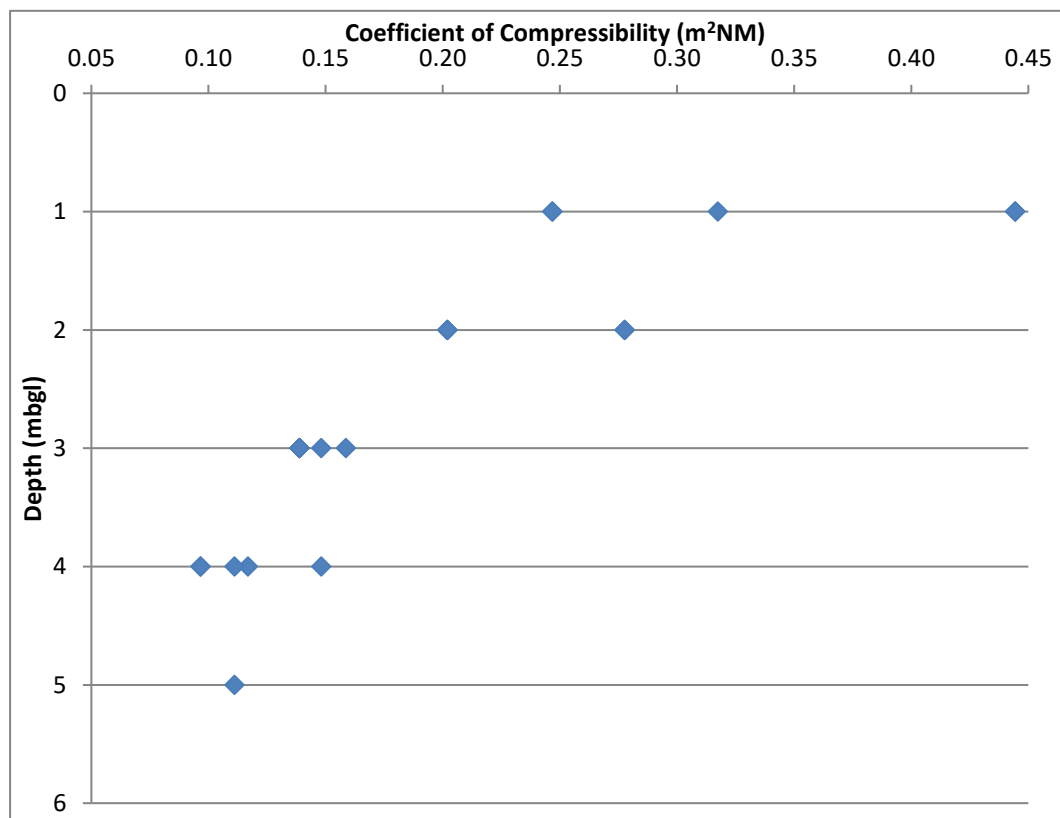
m_v = coefficient of compressibility (m^2/MN)

f_2 = constant dependant on the plasticity index

N = SPT Value achieved during boring operations

9.5.2 Using the plasticity indices obtained (See Table 9.1) and the graphs provided in Tomlinson (2001) a value of f_2 of 0.45 has been taken and used with the SPT 'N' values to infer coefficient of compressibility (m_v).

Figure 9.2: Coefficient of Volume Compressibility (m_v) v Depth



9.5.3 As would be expected the results reduce with depth as the clay increases in strength and the over burden increases, reducing the potential for compressibility.

9.5.4 As would be expected the results from of the London Clay are generally of "low compressibility" with some near surface clays of "medium compressibility". This is considered to be due to the lack of overburden pressure allowing the clays to relax and so compress slightly.

9.6 Building Near Trees

- 9.6.1 The underlying soil conditions have been shown to be of medium to high volume change potential.
- 9.6.2 Using the geotechnical testing obtained (summarised in Table 9.1) and with reference to NHBC Chapter 4.2 it can be seen that a minimum founding depth of 1.5m will be required. This would allow for restricted new planting.
- 9.6.3 Presence of existing and proposed trees may increase this minimum depth. It is recommended that a tree survey that should include: location, species and height of all trees on and near to the proposed development is recommended.
- 9.6.4 Guidance is also given in relation to other aspects of construction where the shrink / swell potential of the soils may be needed to take into consideration. This guidance is summarised in the appropriate sections below.

9.7 In-Situ CBR Measurements

- 9.7.1 California Bearing Ratio tests were undertaken using a perth penetrometer probe at all 5 No windowless sampler positions.
- 9.7.2 All positions are shown on the exploratory hole location plan provided in Appendix 1, Figure 3.
- 9.7.3 The results have been used to calculate CBR values using the methodology outlined in Interim Advice Notice 73/06.
- 9.7.4 The recorded penetration and calculated CBR values from each position are provided in Appendix 6.
- 9.7.5 The results are summarised in Table 9.2 below:

Table 9.2: CBR Results

Position	Initial-Final Depth (mm bgl)	CBR (%)
WS1 (CBR1)	50 - 250	7.4
	250 - 900	1.8
	900 - 1000	26.5
WS2 (CBR2)	50 - 100	15.4
	100 - 550	3.1
	550 - 1000	2.1
WS3 (CBR3)	50 - 350	10.9
	350 - 600	14.3
	600 - 1000	4.8
WS4 (CBR4)	50 - 400	41.9
	400 - 700	26.5

Position	Initial-Final Depth (mm bgl)	CBR (%)
	700 - 1000	9.2
WS5 (CBR5)	50 - 150	49.3
	150 - 800	4.4
	800 - 1000	14.9

- 9.7.6 It is recommended that a value of 2.1% is adopted for the purpose of road design; however, proof rolling of granular Made Ground materials or ground improvement techniques may provide a greater result.
- 9.7.7 As discussed in Interim Advice Notice 73/06, where a subgrade has a CBR lower than 2.5% it is considered unsuitable support for a pavement foundation. It must therefore be permanently improved.
- 9.7.8 Further CBR testing should be undertaken following proof rolling/ground improvement to confirm that suitable improvement was achieved.

9.8 Foundations

- 9.8.1 Foundations should not be formed in either the Made Ground or the Topsoil due to the unacceptable risk of total and differential settlement.
- 9.8.2 From the derived SPT values, allowable bearing capacity has been calculated for traditional strip footings of 1m breadth at varied depths within the London Clay Formation. Values are detailed in Table 9.3 below.

Table 9.3: Shallow Foundation/Bearing Capacity (in Clay)

Depth	Undrained Shear Strength (kPa)	Allowable Bearing Capacity (kPa)
1.5	45	90
2	50	100
2.5	60	115
3	65	125

- 9.8.3 Based upon the information obtained to date, as the proposed development are three storey residential buildings with associated penthouse units, the calculated bearing capacity may not be suitable for the proposed structures. Allowable bearing capacities may be increased by widening the strip footings of the foundations. However this would increase the settlement likely to be experienced by the foundation. In addition a pragmatic approach to site safety and costings suggests that a piled foundation solution within the underlying London Clay Formation should be considered.
- 9.8.4 It is recommended that deeper boreholes are drilled to aid pile design.

- 9.8.5 The above comments are indicative only based on limited ground investigation data. Foundations should be designed by a suitably qualified Engineer. Once structural loads have been fully determined a full design check in accordance with BS EN 1997 should be undertaken to confirm suitability of foundation choice.

9.9 Concrete in the Ground

- 9.9.1 Sulphate attack on building foundations occurs where sulphate solutions react with the various products of hydration in Ordinary Portland Cement (OPC) or converted High-Alumina Cement (HAC). The reaction is expansive, and therefore disruptive, not only due to the formation of minute cracks, but also due to loss of cohesion in the matrix.
- 9.9.2 In accordance with BRE Special Digest 1, as there are less than 10 results in the data set the highest value has been taken.
- 9.9.3 Table 9.4 summarises the analysis of the aggressive nature of the ground for each of the strata encountered within the ground investigation.

Table 9.4: Concrete in the Ground Classes

Stratum	No. Samples	pH range	Highest WS Sulphate (mg/l)	Design Sulphate Class	ACEC Class
Made Ground	6	8.1 – 9.9	783	DS-2	AC-2
London Clay Formation	3	7.5 – 8.2	2200	DS-3	AC-3

9.10 Ground Floor Slabs

- 9.10.1 Formations of the structures should be inspected by a competent person. Any loose or soft material should be removed and replaced with well-graded, properly compacted granular fill or lean mix concrete. The formation should be blinded if left exposed for more than a few hours or if inclement weather is experienced
- 9.10.2 Due to the presence of cohesive ground with a high volume change potential, in accordance with NHBC Chapter 4.2 a suspended floor slab will be required. The depth of clear void beneath the suspended floor slab will be dependant on the floor type used.
- 9.10.3 Under suspended in-situ concrete ground floor a minimum void of 150mm is required. Whilst under suspended precast concrete and timber floors a minimum of 300mm is required.
- 9.10.4 The loadings from the suspended floor slab will need to be carried by the foundations, which will need to be designed to not only carry the structural loadings but the additional floor loadings.

9.11 Excavations

- 9.11.1 It is likely that some shallow excavations will be required at the site for services etc, in addition to larger excavations during the remediation and construction works. These are anticipated to remain stable for the short term only.

- 9.11.2 The stability of all excavations should be assessed during construction. The sides of any excavations into which personnel are required to enter, should be assessed and where necessary fully supported or battered back to a safe angle.
- 9.11.3 Attention is also drawn to the provisions of the Health and Safety at Work Regulations, which state that the sides of any excavations greater than 1.2m depth, into which personnel are required to enter, should be fully supported or battered back to a safe angle.
- 9.12 Groundwater Control**
- 9.12.1 During the investigation no groundwater strikes were reported within the window sample boreholes.
- 9.12.2 During return monitoring groundwater was reported at depths of between 1.62m and 3.11m bgl. Such variance suggests the presence of perched water bodies, as opposed to the natural groundwater table.
- 9.12.3 Subject to seasonal variations, any groundwater encountered during site works could be readily dealt with by conventional pumping from a sump used to collate waters.
- 9.12.4 Surface water or rainfall ingress could be similarly dealt with.

10 REFERENCES

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CIRIA C665 (2007) *Assessing risks posed by hazardous ground gases to buildings* London, CIRIA

British Standards Institution (2015) BS 8485:2015 Incorporating corrigendum No.1 *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* Milton Keynes: BSI

British Standards Institution (2013) BS 8576:2013 *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOC's)*, Milton Keynes: BSI

APPENDICES

APPENDIX 1 – FIGURES



JOMAS ASSOCIATES LTD
T: 0843 289 2187

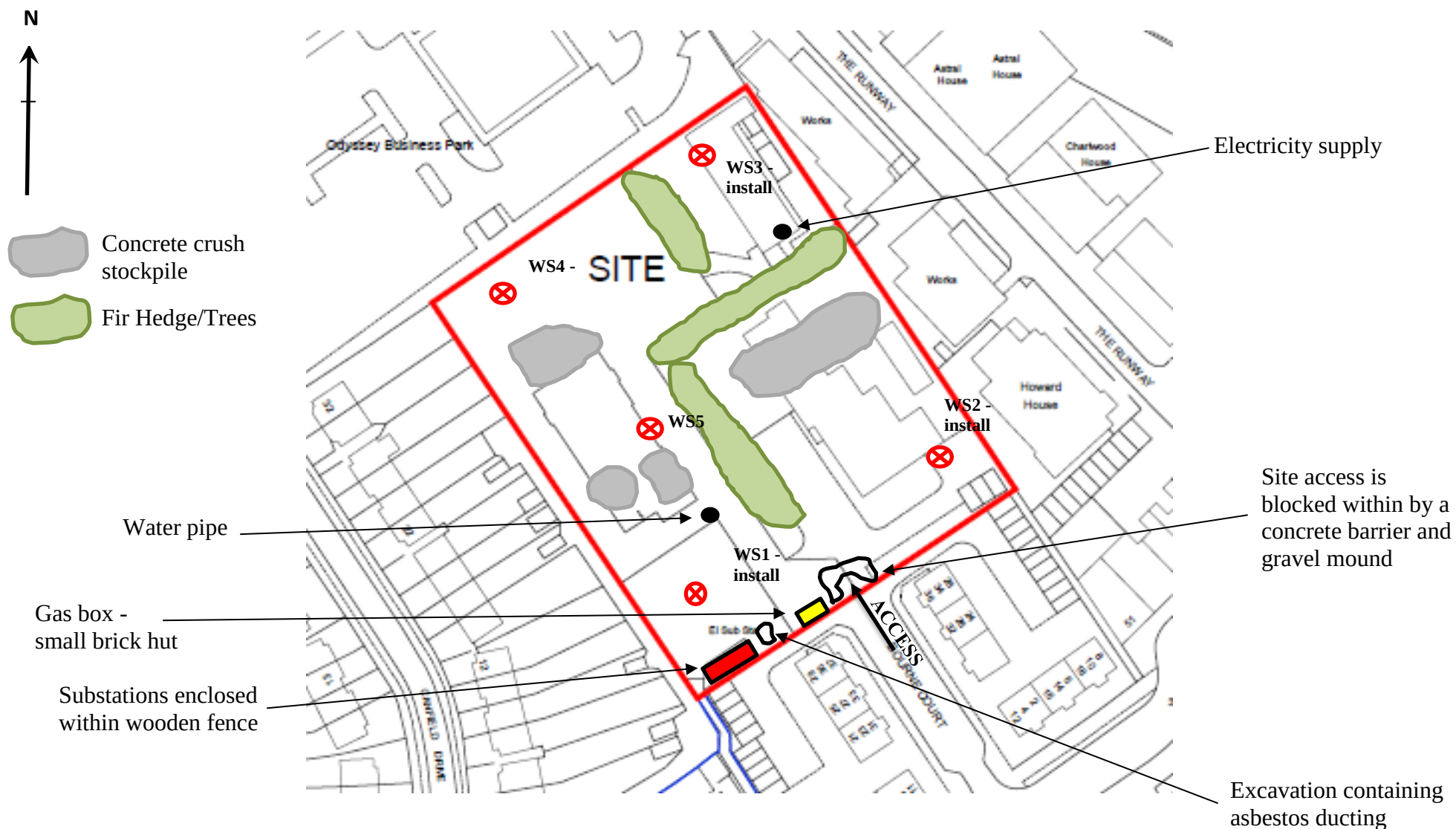
Project Name	Land Adjacent to 37 Bourne Court	Client	Clearview Homes
Project No.	P1528J1393	Date	May 2018
Title	Site Location Plan	Figure	1



Project Name	Land Adjacent to 37 Bourne Court, Ruislip	Client	Clearview Homes
Project No./Figure	P1528J1393/Figure 2	Date	May 2018
Title	Proposed Development Plan	Prepared By	TE



Project Name	Bourne Court, Ruislip	Client	Clearview Homes
Project No./Figure	P1528J1393/ Figure 3	Date	29/08/2018
Title	GI plan	Prepared By	SL



Project Name	Bourne Court, Ruislip	Client	Clearview Homes
Title	WS Drilling Photographic Log	Project	P1528J1393

Photo 1: WS1**Photo 2: WS2**



Project Name	Bourne Court, Ruislip	Client	Clearview Homes
Title	WS Drilling Photographic Log	Project	P1528J1393

Photo 3: WS3



Photo 4: WS4





Project Name	Bourne Court, Ruislip	Client	Clearview Homes
Title	WS Drilling Photographic Log	Project	P1528J1393

Photo 5: WS5



APPENDIX 2 – EXPLORATORY HOLE RECORDS



WINDOW / WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:

WS1

Site Address: Bourne Court, South Ruislip, HA4 6SW

Client: Clearview Homes

Logged By: JN

Checked By: SL

Type and diameter of equipment: Windowless Sampler

Project No: P1528J1393

Ground Level:

Date Commenced: 30/08/2018

Date Completed: 30/08/2018

Sheet No: 1 Of 1

Water levels recorded during boring, m

Date:

Hole depth:

Casing depth:

Level water on strike:

Water Level after 20mins:

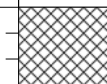
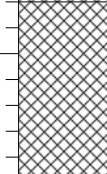
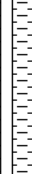
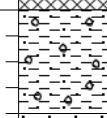
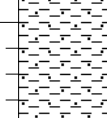
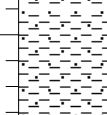
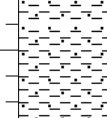
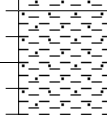
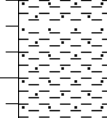
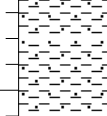
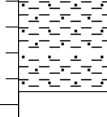
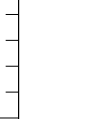
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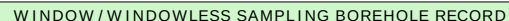
2: *Field description.

3:

4:

Sample or Tests										Strata			Strata Description	Installation	
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)			
		75	75	75	75	75	75	N							
PJV	0.25								0.00		0.30		Dark brown-black gravelly sand. Gravel consists of fine to coarse angular to sub-rounded flint, brick and concrete. (MADE GROUND).		
PJV	0.50								0.50				Soft to firm consistency* geen-grey sandy slightly gravelly clay. Gravel consists of fine to medium sub-angular to sub-rounded brick and concrete. Slight organic odour noted. (MADE GROUND).		
PJV S	1.00	1	0	1	2	2	2	7	1.00		1.00		Brown with grey patches low strength sandy slightly gravelly CLAY. Gravel consists of medium to coarse angular to sub-angular claystone. Contains occasional rootlets. (LONDON CLAY FORMATION).		
PJV S	2.00	1	1	2	3	3	3	11	1.50		1.40		Orange-brown with grey patches medium strength sandy CLAY. Contains occasional selenite crystals and infrequent rootlets. (LONDON CLAY FORMATION).		
PJV S	3.00	1	1	3	3	5	5	16	2.00		2.80		Yellow brown with grey patches high to medium strength CLAY. Contains frequent selenite crystals. (LONDON CLAY FORMATION).		
PJV S	4.00	1	2	3	3	4	5	15	2.50		4.00				
									3.00		4.45				
									3.50						
									4.00						
									4.50						
									5.00						

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample
Jomas Associates Ltd - Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD
T: 0843 289 2187 E: info@jomasassociates.com W: www.jomasassociates.com



Exploratory Hole No:

WS2

Site Address:	Bourne Court, South Ruislip, HA4 6SW
---------------	--------------------------------------

Project No:	P1528J1393
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Client:	Clearview Homes
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Ground Level:

Logged By:

Date Commenced:	30/08/2018
-----------------	------------

Checked By:

Date Completed:	30/08/2018
-----------------	------------

Type and diameter of equipment:	Windowless Sampler
---------------------------------	--------------------

Sheet No: 1 Of 1

Water levels recorded during boring, m

Date:

Hole depth:

Casing depth:

Level water on strike:

Water Level after 20mins:

Remarks

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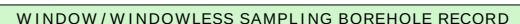
2:

3:

4:

Sample or Tests										Strata			Strata Description	Installation
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N						
PJV	0.15								0.00		0.20		Black gravelly sand. Gravel consists of fine to coarse angular to sub-rounded flint, brick and concrete. (MADE GROUND).	
PJV	0.50								0.50		0.60		Firm consistency* brown slightly sandy slightly gravelly CLAY. Contains frequent rootlets. (LONDON CLAY FORMATION).	
PJV S	1.00	1	1	1	1	2	1	5	1.00				Pale brown slightly mottled medium strength sandy CLAY. Contains occasional rootlets and selenite crystals from around 1.50m bgl. (LONDON CLAY FORMATION).	
									1.50					
PJV S	2.00	1	2	2	2	2	2	8	2.00					
									2.50					
									3.00		2.90		Pale orange-brown high strength sandy slightly gravelly CLAY. Gravel consists of fine to medium angular to sub-angular claystone. Contains frequent selentie crystals. (LONDON CLAY FORMATION).	
									3.50					
									4.00					
PJV S	4.00	3	4	5	5	6	7	23	4.45					
									4.50					
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample
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WS3

Project No:	P1528J1393
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Ground Level:

Date Commenced:	30/08/2018
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Date Completed:	30/08/2018
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Sheet No:	1 Of 1
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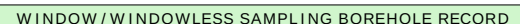
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Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

3:

Sample or Tests										Strata			Strata Description	Installation
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N						

[illegible]

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample
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Exploratory Hole No:

WS4

Site Address:	Bourne Court, South Ruislip, HA4 6SW
---------------	--------------------------------------

Project No:	P1528J1393
-------------	------------

Client:	Clearview Homes
---------	-----------------

Ground Level:

Logged By:

Date Commenced:	30/08/2018
-----------------	------------

Checked By:

Date Completed:	30/08/2018
-----------------	------------

Type and diameter of equipment:	Windowless Sampler
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Sheet No:	1 Of 1
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Water levels recorded during boring, m

Date:

Hole depth:

Casing depth:

Level water on strike:

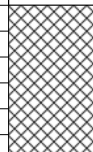
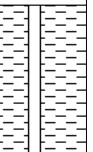
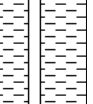
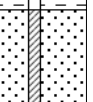
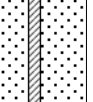
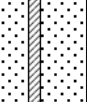
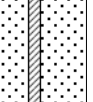
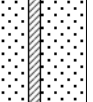
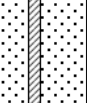
Water Level after 20mins:

Remarks

1: No water reported.
2: *Field description.

3:

4:

Sample or Tests										Strata			Strata Description	Installation	
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)			
		75	75	75	75	75	75	N							
PJV	0.25								0.00				Grass over soft to firm consistency* silty sandy gravelly clay. Gravel consists of fine to coarse angular to sub-rounded flint, brick and concrete. Contains occassional rootlets. (MADE GROUND).		
PJV	0.50								0.50		0.60				
PJV	1.00								1.00				Firm consistency* dark brown grey black slightly sandy gravelly CLAY with a slight organic odour. (LONDON CLAY FORMATION).		
S		2	2	1	3	2	3	9	1.50						
PJV	2.00								2.00				Brown occasionally mottled orange medium strength sandy CLAY. Contains occasional selenite crystals. (LONDON CLAY FORMATION).		
S		1	1	3	3	2	3	11	2.50						
PJV	3.00								3.00						
S		2	3	3	4	4	4	15	3.50						
PJV	4.00								4.00				Brown high strength closely fissured sandy CLAY. Contains occassional selenite crystals. Brown occasionally mottled medium becoming high strength CLAY. Contains frequent selenite crystals. (LONDON CLAY FORMATION).		
S		2	2	3	5	5	6	19	4.45						
									4.50						
									5.00						

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample
 Jomas Associates Ltd - Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD
 T: 0843 289 2187 E: info@jomasassociates.com W: www.jomasassociates.com



WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:

WS5

Site Address: Bourne Court, South Ruislip, HA4 6SW

Client: Clearview Homes

Logged By: JN

Checked By:

Type and diameter of equipment: Windowless Sampler

Project No: P1528J1393

Ground Level:

Date Commenced: 30/08/2018

Date Completed: 30/08/2018

Sheet No: 1 Of 2

Water levels recorded during boring, m

Date:

Hole depth:

Casing depth:

Level water on strike:

Water Level after 20mins:

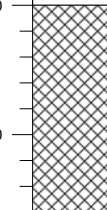
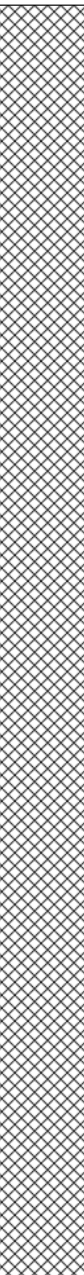
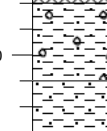
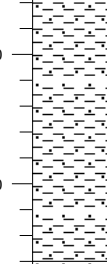
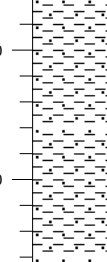
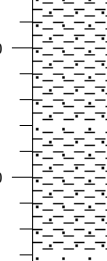
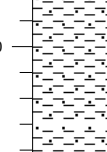
Remarks

1: No water reported.

2: *Field description.

3:

4:

Sample or Tests										Strata			Strata Description	Installation	
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)			
		75	75	75	75	75	75	N							
PJV	0.25								0.00				Soft to firm consistency* grey-brown sandy gravelly CLAY with low cobble content. Gravel consists of fine to medium angular to rounded flint, brick and concrete. (MADE GROUND).		
PJV	0.50								0.50						
									0.80						
PJV S	1.00	0	3	3	2	2	2	9	1.00			Firm consistency* brown mottled firm sandy slightly gravelly CLAY. Gravel consists of fine to coarse angular to sub-angular claystone. Brown occasionally mottled medium becoming high strength CLAY. Contains frequent selenite crystals. (LONDON CLAY FORMATION).			
									1.10						
									1.50			Brown medium strength slightly sandy CLAY. Contains occasional gleying and infrequent bands of fine flint gravel. Brown occasionally mottled medium becoming high strength CLAY. Contains frequent selenite crystals. (LONDON CLAY FORMATION).			
PJV S	2.00	1	2	2	2	3	4	11	2.00						
									2.30						
									2.50			Orange-brown medium becoming high strength sandy CLAY. Contains frequent selenite crystals. Brown occasionally mottled medium becoming high strength CLAY. Contains frequent selenite crystals. (LONDON CLAY FORMATION).			
PJV S	3.00	2	3	3	4	3	4	14	3.00						
									3.50						
									4.00						
PJV S	4.00	3	4	4	5	5	6	20	4.00						
									4.50						
									5.00						
PJV S	5.00	2	5	5	4	5	6	20	5.00						

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample
Jomas Associates Ltd - Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD
T: 0843 289 2187 E: info@jomasassociates.com W: www.jomasassociates.com



WINDOW / WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:

WS5

Site Address: Bourne Court, South Ruislip, HA4 6SW

Client: Clearview Homes

Logged By: JN

Checked By:

Type and diameter of equipment: Windowless Sampler

Project No: P1528J1393

Ground Level:

Date Commenced: 30/08/2018

Date Completed: 30/08/2018

Sheet No: 2 Of 2

Water levels recorded during boring, m

Date:

Hole depth:

Casing depth:

Level water on strike:

Water Level after 20mins:

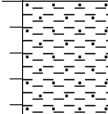
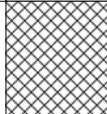
Remarks

1: No water reported.

2: *Field description.

3:

4:

Sample or Tests										Strata			Strata Description	Installation
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)		
		75	75	75	75	75	75	N						
PJV S	5.00	2	5	5	4	5	6	20	5.00		5.45	Orange-brown medium becoming high strength sandy CLAY. Contains frequent selenite crystals. Brown occassionally mottled medium becoming high strength CLAY. Contains frequent selenite crystals. (LONDON CLAY FORMATION).		
									5.50					
									6.00					
									6.50					
									7.00					
									7.50					
									8.00					
									8.50					
									9.00					
									9.50					
									10.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample
Jomas Associates Ltd - Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD
T: 0843 289 2187 E: info@jomasassociates.com W: www.jomasassociates.com

APPENDIX 3 – CHEMICAL LABORATORY TEST RESULTS

**Emma Hucker**

Jomas Associates Ltd
Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: Jomas Associates -

Analytical Report Number : 18-99090

Project / Site name:	Bourne Court, South Ruislip HA4 6SW	Samples received on:	03/09/2018
Your job number:	JJ1393	Samples instructed on:	05/09/2018
Your order number:	P1528JJ1393.4	Analysis completed by:	12/09/2018
Report Issue Number:	1	Report issued on:	12/09/2018
Samples Analysed:	9 soil samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number	1039091	1039092	1039093	1039094	1039095
Sample Reference	WS1	WS2	WS3	WS4	WS5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.15	0.25	0.50	0.50
Date Sampled	30/08/2018	30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	19	13
Total mass of sample received	kg	0.001	NONE	2.0	0.78
				1.9	1.1

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile- Loose Fibres	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Detected	Not-detected	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	8.5	9.9	9.8	8.7
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	710	1400	1400	2800	820
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.21	0.18	0.10	0.78	0.13
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	213	183	102	783	134
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.1	4.1	2.2	0.8	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.14	0.20	< 0.05	< 0.05	0.33
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.14
Fluorene	mg/kg	0.05	MCERTS	0.27	< 0.05	< 0.05	< 0.05	0.16
Phenanthrene	mg/kg	0.05	MCERTS	3.0	1.5	0.23	2.1	2.5
Anthracene	mg/kg	0.05	MCERTS	0.85	0.40	0.11	0.62	0.95
Fluoranthene	mg/kg	0.05	MCERTS	4.7	3.8	0.59	4.1	8.4
Pyrene	mg/kg	0.05	MCERTS	4.0	3.5	0.54	3.2	7.5
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.2	2.7	0.50	2.2	5.9
Chrysene	mg/kg	0.05	MCERTS	2.8	2.5	0.45	2.0	4.9
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	3.6	2.9	0.58	2.0	6.4
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	2.3	1.7	0.35	1.3	3.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.8	2.8	0.42	1.8	6.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	3.2	2.4	0.44	1.2	4.8
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.87	< 0.05	< 0.05	< 0.05	1.2
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.8	2.8	0.61	1.5	5.6

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	36.4	27.1	4.82	22.0	58.4
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	15	32	15	55	15
Boron (water soluble)	mg/kg	0.2	MCERTS	2.7	2.6	2.0	1.7	2.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.7	2.6	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	38	25	210	46	43
Copper (aqua regia extractable)	mg/kg	1	MCERTS	21	130	33	32	33
Lead (aqua regia extractable)	mg/kg	1	MCERTS	26	91	32	78	47
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	28	62	31	150	40
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.8	2.3	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	70	110	110	260	98

Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number	1039091	1039092	1039093	1039094	1039095
Sample Reference	WS1	WS2	WS3	WS4	WS5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.15	0.25	0.50	0.50
Date Sampled	30/08/2018	30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	µg/kg	1	MCERTS	-	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	-
o-xylene	µg/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-

Petroleum Hydrocarbons

Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
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TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-

TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	14	< 4.0	< 4.0	< 4.0	7.8
TPH (C16 - C21)	mg/kg	1	MCERTS	77	25	13	68	58
TPH (C21 - C40)	mg/kg	10	MCERTS	330	100	440	400	230



Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number				1039091	1039092	1039093	1039094	1039095
Sample Reference				WS1	WS2	WS3	WS4	WS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.15	0.25	0.50	0.50
Date Sampled				30/08/2018	30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

VOCs

Chloromethane	µg/kg	1	ISO 17025	-	-	-	-	-
Chloroethane	µg/kg	1	NONE	-	-	-	-	-
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	-
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	-
Benzene	µg/kg	1	MCERTS	-	-	-	-	-
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	-
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-	-
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-	-
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-	-
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-	-
Styrene	µg/kg	1	MCERTS	-	-	-	-	-
Tribromomethane	µg/kg	1	NONE	-	-	-	-	-
o-Xylene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	-
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	-



Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number				1039091	1039092	1039093	1039094	1039095
Sample Reference				WS1	WS2	WS3	WS4	WS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.15	0.25	0.50	0.50
Date Sampled				30/08/2018	30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

PCBs by GC-MS

PCB Congener 28	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 52	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 101	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 118	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 138	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 153	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 180	mg/kg	0.001	MCERTS	-	-	-	-	-

Total PCBs by GC-MS

Total PCBs	mg/kg	0.007	MCERTS	-	-	-	-	-
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Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number				1039096	1039097	1039098	1039099	
Sample Reference				WS1	WS5	WS4	WS2	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				0.25	4.00	2.00	3.00	
Date Sampled				30/08/2018	30/08/2018	30/08/2018	30/08/2018	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	5.5	18	18	20	
Total mass of sample received	kg	0.001	NONE	2.0	0.83	2.0	1.7	

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	-	

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.3	8.2	7.8	7.5	
Total Cyanide	mg/kg	1	MCERTS	< 1	-	-	-	
Total Sulphate as SO ₄	mg/kg	50	MCERTS	1300	-	-	-	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.14	1.2	2.1	2.2	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	139	-	-	-	
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	-	-	
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.29	-	-	-	
Acenaphthylene	mg/kg	0.05	MCERTS	1.8	-	-	-	
Acenaphthene	mg/kg	0.05	MCERTS	0.52	-	-	-	
Fluorene	mg/kg	0.05	MCERTS	0.66	-	-	-	
Phenanthrene	mg/kg	0.05	MCERTS	8.2	-	-	-	
Anthracene	mg/kg	0.05	MCERTS	4.2	-	-	-	
Fluoranthene	mg/kg	0.05	MCERTS	35	-	-	-	
Pyrene	mg/kg	0.05	MCERTS	33	-	-	-	
Benzo(a)anthracene	mg/kg	0.05	MCERTS	29	-	-	-	
Chrysene	mg/kg	0.05	MCERTS	31	-	-	-	
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	43	-	-	-	
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	23	-	-	-	
Benzo(a)pyrene	mg/kg	0.05	MCERTS	42	-	-	-	
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	31	-	-	-	
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	8.4	-	-	-	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	37	-	-	-	

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	329	-	-	-	
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	-	-	-	
Boron (water soluble)	mg/kg	0.2	MCERTS	1.4	-	-	-	
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.9	-	-	-	
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	-	-	-	
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	-	-	-	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	28	-	-	-	
Lead (aqua regia extractable)	mg/kg	1	MCERTS	66	-	-	-	
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-	-	
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	-	-	-	
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-	-	
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	-	-	-	

Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number	1039096	1039097	1039098	1039099	
Sample Reference	WS1	WS5	WS4	WS2	
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)	0.25	4.00	2.00	3.00	
Date Sampled	30/08/2018	30/08/2018	30/08/2018	30/08/2018	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	
o-xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	-	

Petroleum Hydrocarbons

Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-	-	-	-	
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TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	1.7	-	-	-	
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	12	-	-	-	
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	42	-	-	-	
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	260	-	-	-	
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	320	-	-	-	

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-	-	
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	2.4	-	-	-	
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	96	-	-	-	
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	700	-	-	-	
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	800	-	-	-	

TPH (C10 - C12)	mg/kg	2	MCERTS	-	-	-	-	
TPH (C12 - C16)	mg/kg	4	MCERTS	-	-	-	-	
TPH (C16 - C21)	mg/kg	1	MCERTS	-	-	-	-	
TPH (C21 - C40)	mg/kg	10	MCERTS	-	-	-	-	

Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number				1039096	1039097	1039098	1039099
Sample Reference				WS1	WS5	WS4	WS2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.25	4.00	2.00	3.00
Date Sampled				30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
VOCs							
Chloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	-
Chloroethane	µg/kg	1	NONE	< 1.0	-	-	-
Bromomethane	µg/kg	1	ISO 17025	< 1.0	-	-	-
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	-
Trichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	-
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	-
Trichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	-
Dibromomethane	µg/kg	1	MCERTS	< 1.0	-	-	-
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	-
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	-	-	-
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	-
Styrene	µg/kg	1	MCERTS	< 1.0	-	-	-
Tribromomethane	µg/kg	1	NONE	< 1.0	-	-	-
o-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
Bromobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	-	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-



Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number				1039096	1039097	1039098	1039099	
Sample Reference				WS1	WS5	WS4	WS2	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				0.25	4.00	2.00	3.00	
Date Sampled				30/08/2018	30/08/2018	30/08/2018	30/08/2018	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
PCBs by GC-MS								
PCB Congener 28	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
PCB Congener 52	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
PCB Congener 101	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
PCB Congener 118	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
PCB Congener 138	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
PCB Congener 153	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
PCB Congener 180	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
Total PCBs by GC-MS								
Total PCBs	mg/kg	0.007	MCERTS	< 0.007	-	-	-	



Analytical Report Number : 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1039091	WS1	None Supplied	0.50	Brown clay with gravel.
1039092	WS2	None Supplied	0.15	Brown loam and sand with gravel and vegetation.
1039093	WS3	None Supplied	0.25	Brown loam and sand with gravel and vegetation.
1039094	WS4	None Supplied	0.50	Brown clay and sand with gravel and vegetation.
1039095	WS5	None Supplied	0.50	Brown clay with gravel.
1039096	WS1	None Supplied	0.25	Brown loam and sand with gravel.
1039097	WS5	None Supplied	4.00	Grey clay.
1039098	WS4	None Supplied	2.00	Brown clay with gravel.
1039099	WS2	None Supplied	3.00	Grey clay with gravel.

Analytical Report Number : 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding.	L076-PL	D	MCERTS

Iss No 18-99090-1 Bourne Court, South Ruislip HA4 6SW JJ1393

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The results included within the report are representative of the samples submitted for analysis.

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Analytical Report Number : 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L088/76-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

**Emma Hucker**

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Analytical Report Number : 18-99090

Replaces Analytical Report Number : 18-99090, issue no. 1

Project / Site name:	Bourne Court, South Ruislip HA4 6SW	Samples received on:	03/09/2018
Your job number:	JJ1393	Samples instructed on:	05/09/2018
Your order number:	P1528JJ1393.4	Analysis completed by:	14/09/2018
Report Issue Number:	2	Report issued on:	14/09/2018
Samples Analysed:	9 soil samples		

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Environmental Science

Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number	1039091	1039092	1039093	1039094	1039095
Sample Reference	WS1	WS2	WS3	WS4	WS5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.15	0.25	0.50	0.50
Date Sampled	30/08/2018	30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	19	13
Total mass of sample received	kg	0.001	NONE	7.0	16
				1.9	20
				1.9	1.1

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Detected	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	< 0.001	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	< 0.001	-	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	8.5	9.9	9.8	8.7
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	710	1400	1400	2800	820
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.21	0.18	0.10	0.78	0.13
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	213	183	102	783	134
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.1	4.1	2.2	0.8	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.14	0.20	< 0.05	< 0.05	0.33
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.14
Fluorene	mg/kg	0.05	MCERTS	0.27	< 0.05	< 0.05	< 0.05	0.16
Phenanthrene	mg/kg	0.05	MCERTS	3.0	1.5	0.23	2.1	2.5
Anthracene	mg/kg	0.05	MCERTS	0.85	0.40	0.11	0.62	0.95
Fluoranthene	mg/kg	0.05	MCERTS	4.7	3.8	0.59	4.1	8.4
Pyrene	mg/kg	0.05	MCERTS	4.0	3.5	0.54	3.2	7.5
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.2	2.7	0.50	2.2	5.9
Chrysene	mg/kg	0.05	MCERTS	2.8	2.5	0.45	2.0	4.9
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	3.6	2.9	0.58	2.0	6.4
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	2.3	1.7	0.35	1.3	3.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.8	2.8	0.42	1.8	6.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	3.2	2.4	0.44	1.2	4.8
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.87	< 0.05	< 0.05	< 0.05	1.2
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.8	2.8	0.61	1.5	5.6

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	36.4	27.1	4.82	22.0	58.4
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	15	32	15	55	15
Boron (water soluble)	mg/kg	0.2	MCERTS	2.7	2.6	2.0	1.7	2.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.7	2.6	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	38	25	210	46	43
Copper (aqua regia extractable)	mg/kg	1	MCERTS	21	130	33	32	33
Lead (aqua regia extractable)	mg/kg	1	MCERTS	26	91	32	78	47
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	28	62	31	150	40
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.8	2.3	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	70	110	110	260	98

Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number	1039091	1039092	1039093	1039094	1039095
Sample Reference	WS1	WS2	WS3	WS4	WS5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.15	0.25	0.50	0.50
Date Sampled	30/08/2018	30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	ug/kg	1	MCERTS	-	-	-	-	-
Toluene	ug/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	ug/kg	1	MCERTS	-	-	-	-	-
p & m-xylene	ug/kg	1	MCERTS	-	-	-	-	-
o-xylene	ug/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	-	-	-	-	-

Petroleum Hydrocarbons

Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
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TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-

TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	14	< 4.0	< 4.0	< 4.0	7.8
TPH (C16 - C21)	mg/kg	1	MCERTS	77	25	13	68	58
TPH (C21 - C40)	mg/kg	10	MCERTS	330	100	440	400	230



Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number	1039091	1039092	1039093	1039094	1039095
Sample Reference	WS1	WS2	WS3	WS4	WS5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.15	0.25	0.50	0.50
Date Sampled	30/08/2018	30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

VOCs

Chloromethane	µg/kg	1	ISO 17025	-	-	-	-	-
Chloroethane	µg/kg	1	NONE	-	-	-	-	-
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	-
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	-
Benzene	µg/kg	1	MCERTS	-	-	-	-	-
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	-
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-	-
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-	-
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-	-
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-	-
Styrene	µg/kg	1	MCERTS	-	-	-	-	-
Tribromomethane	µg/kg	1	NONE	-	-	-	-	-
o-Xylene	µg/kg	1	MCERTS	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	-
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	-



Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number	1039091	1039092	1039093	1039094	1039095
Sample Reference	WS1	WS2	WS3	WS4	WS5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.15	0.25	0.50	0.50
Date Sampled	30/08/2018	30/08/2018	30/08/2018	30/08/2018	30/08/2018
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

PCBs by GC-MS

PCB Congener 28	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 52	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 101	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 118	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 138	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 153	mg/kg	0.001	MCERTS	-	-	-	-	-
PCB Congener 180	mg/kg	0.001	MCERTS	-	-	-	-	-

Total PCBs by GC-MS

Total PCBs	mg/kg	0.007	MCERTS	-	-	-	-	-
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Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number	1039096	1039097	1039098	1039099	
Sample Reference	WS1	WS5	WS4	WS2	
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)	0.25	4.00	2.00	3.00	
Date Sampled	30/08/2018	30/08/2018	30/08/2018	30/08/2018	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	5.5	18
Total mass of sample received	kg	0.001	NONE	2.0	0.83

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	-	
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.3	8.2	7.8	7.5	
Total Cyanide	mg/kg	1	MCERTS	< 1	-	-	-	
Total Sulphate as SO ₄	mg/kg	50	MCERTS	1300	-	-	-	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.14	1.2	2.1	2.2	
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	139	-	-	-	
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	-	-	
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.29	-	-	-	
Acenaphthylene	mg/kg	0.05	MCERTS	1.8	-	-	-	
Acenaphthene	mg/kg	0.05	MCERTS	0.52	-	-	-	
Fluorene	mg/kg	0.05	MCERTS	0.66	-	-	-	
Phenanthrene	mg/kg	0.05	MCERTS	8.2	-	-	-	
Anthracene	mg/kg	0.05	MCERTS	4.2	-	-	-	
Fluoranthene	mg/kg	0.05	MCERTS	35	-	-	-	
Pyrene	mg/kg	0.05	MCERTS	33	-	-	-	
Benzo(a)anthracene	mg/kg	0.05	MCERTS	29	-	-	-	
Chrysene	mg/kg	0.05	MCERTS	31	-	-	-	
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	43	-	-	-	
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	23	-	-	-	
Benzo(a)pyrene	mg/kg	0.05	MCERTS	42	-	-	-	
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	31	-	-	-	
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	8.4	-	-	-	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	37	-	-	-	

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	329	-	-	-	
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	-	-	-	
Boron (water soluble)	mg/kg	0.2	MCERTS	1.4	-	-	-	
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.9	-	-	-	
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	-	-	-	
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	-	-	-	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	28	-	-	-	
Lead (aqua regia extractable)	mg/kg	1	MCERTS	66	-	-	-	
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-	-	
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	-	-	-	
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-	-	
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	-	-	-	

Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number				1039096	1039097	1039098	1039099	
Sample Reference				WS1	WS5	WS4	WS2	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				0.25	4.00	2.00	3.00	
Date Sampled				30/08/2018	30/08/2018	30/08/2018	30/08/2018	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	< 1.0	-	-	-	
Toluene	ug/kg	1	MCERTS	< 1.0	-	-	-	
Ethylbenzene	ug/kg	1	MCERTS	< 1.0	-	-	-	
p & m-xylene	ug/kg	1	MCERTS	< 1.0	-	-	-	
o-xylene	ug/kg	1	MCERTS	< 1.0	-	-	-	
MTBE (Methyl Tertiary Butyl Ether)	ug/kg	1	MCERTS	< 1.0	-	-	-	

Petroleum Hydrocarbons

Petroleum Range Organics (C6 - C10)	mg/kg	0.1	MCERTS	-	-	-	-	
TPH-CWG - Aliphatic >EC5 - EC6								
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	1.7	-	-	-	
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	12	-	-	-	
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	42	-	-	-	
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	260	-	-	-	
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	320	-	-	-	
TPH-CWG - Aromatic >EC5 - EC7								
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	-	
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-	-	
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	2.4	-	-	-	
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	96	-	-	-	
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	700	-	-	-	
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	800	-	-	-	
TPH (C10 - C12)								
TPH (C10 - C12)	mg/kg	2	MCERTS	-	-	-	-	
TPH (C12 - C16)	mg/kg	4	MCERTS	-	-	-	-	
TPH (C16 - C21)	mg/kg	1	MCERTS	-	-	-	-	
TPH (C21 - C40)	mg/kg	10	MCERTS	-	-	-	-	



Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number				1039096	1039097	1039098	1039099	
Sample Reference				WS1	WS5	WS4	WS2	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				0.25	4.00	2.00	3.00	
Date Sampled				30/08/2018	30/08/2018	30/08/2018	30/08/2018	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	
Chloroethane	µg/kg	1	NONE	< 1.0	-	-	-	
Bromomethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	-	-	
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	-	-	
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-	
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	-	
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	-	
Trichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-	
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	-	
Trichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Dibromomethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	-	
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	-	
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	-	
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	-	-	
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	-	-	-	
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Styrene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Tribromomethane	µg/kg	1	NONE	< 1.0	-	-	-	
o-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	-	
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Bromobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	-	
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	-	-	-	
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	-	
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	-	
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	-	-	-	
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	-	

Analytical Report Number: 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Your Order No: P1528JJ1393.4

Lab Sample Number				1039096	1039097	1039098	1039099	
Sample Reference				WS1	WS5	WS4	WS2	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				0.25	4.00	2.00	3.00	
Date Sampled				30/08/2018	30/08/2018	30/08/2018	30/08/2018	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		
PCBs by GC-MS								
PCB Congener 28				mg/kg	0.001	MCERTS	< 0.001	-
PCB Congener 52				mg/kg	0.001	MCERTS	< 0.001	-
PCB Congener 101				mg/kg	0.001	MCERTS	< 0.001	-
PCB Congener 118				mg/kg	0.001	MCERTS	< 0.001	-
PCB Congener 138				mg/kg	0.001	MCERTS	< 0.001	-
PCB Congener 153				mg/kg	0.001	MCERTS	< 0.001	-
PCB Congener 180				mg/kg	0.001	MCERTS	< 0.001	-
Total PCBs by GC-MS								
Total PCBs				mg/kg	0.007	MCERTS	< 0.007	-



Analytical Report Number: 18-99090
Project / Site name: Bourne Court, South Ruislip HA4 6SW
Your Order No: P1528JJ1393.4

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
1039093	WS3	0.25	171	Loose Fibres	Chrysotile	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.



Analytical Report Number : 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1039091	WS1	None Supplied	0.50	Brown clay with gravel.
1039092	WS2	None Supplied	0.15	Brown loam and sand with gravel and vegetation.
1039093	WS3	None Supplied	0.25	Brown loam and sand with gravel and vegetation.
1039094	WS4	None Supplied	0.50	Brown clay and sand with gravel and vegetation.
1039095	WS5	None Supplied	0.50	Brown clay with gravel.
1039096	WS1	None Supplied	0.25	Brown loam and sand with gravel.
1039097	WS5	None Supplied	4.00	Grey clay.
1039098	WS4	None Supplied	2.00	Brown clay with gravel.
1039099	WS2	None Supplied	3.00	Grey clay with gravel.

Analytical Report Number : 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS

Iss No 18-99090-2 Bourne Court, South Ruislip HA4 6SW JJ1393

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The results included within the report are representative of the samples submitted for analysis.

Page 12 of 13



Analytical Report Number : 18-99090

Project / Site name: Bourne Court, South Ruislip HA4 6SW

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding.	L076-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L088/76-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX 4 – GEOTECHNICAL LABORATORY TEST RESULTS



TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Jomas Associates Ltd
Client Address: Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD
Contact: Emma Hucker
Site Name: Bourne Court South Ruislip
Site Address: Bourne Court South Ruislip

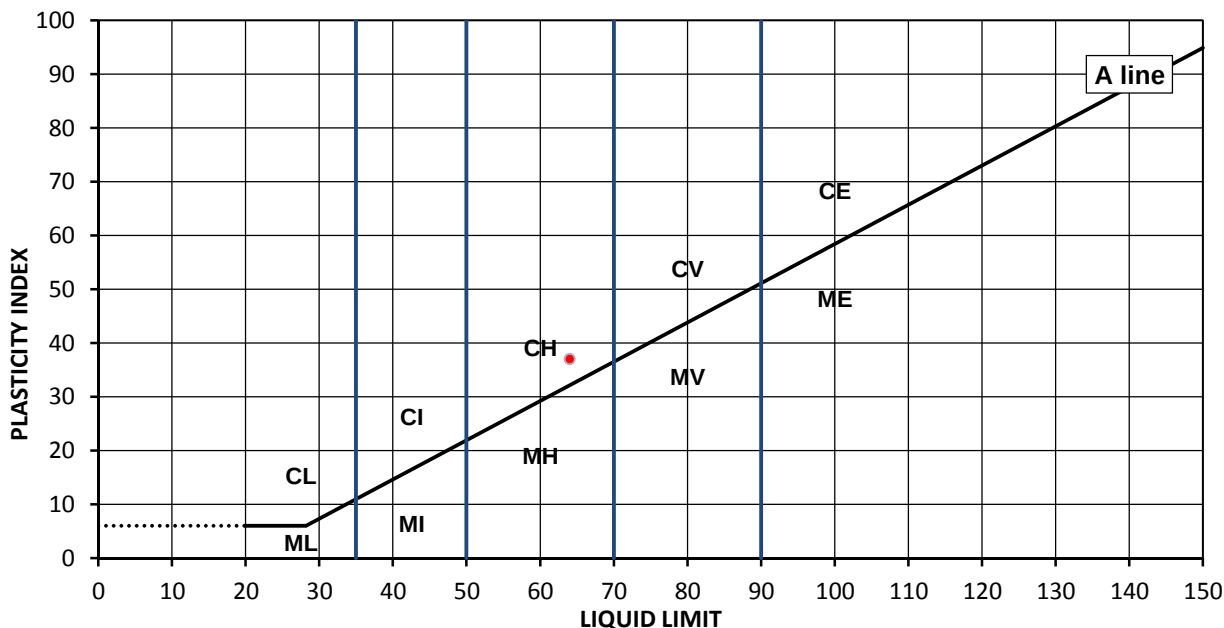
Client Reference: JJ1393
Job Number: 18-99369
Date Sampled: Not Given
Date Received: 03/09/2018
Date Tested: 13/09/2018
Sampled By: Not Given

Test Results

Laboratory Reference: 1040718
Hole No.: WS1
Sample Reference: Not Given
Soil Description: Yellowish brown CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 3.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
28	64	27	37	100



Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 19/09/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."



TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Jomas Associates Ltd
Client Address: Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD
Contact: Emma Hucker
Site Name: Bourne Court South Ruislip
Site Address: Bourne Court South Ruislip

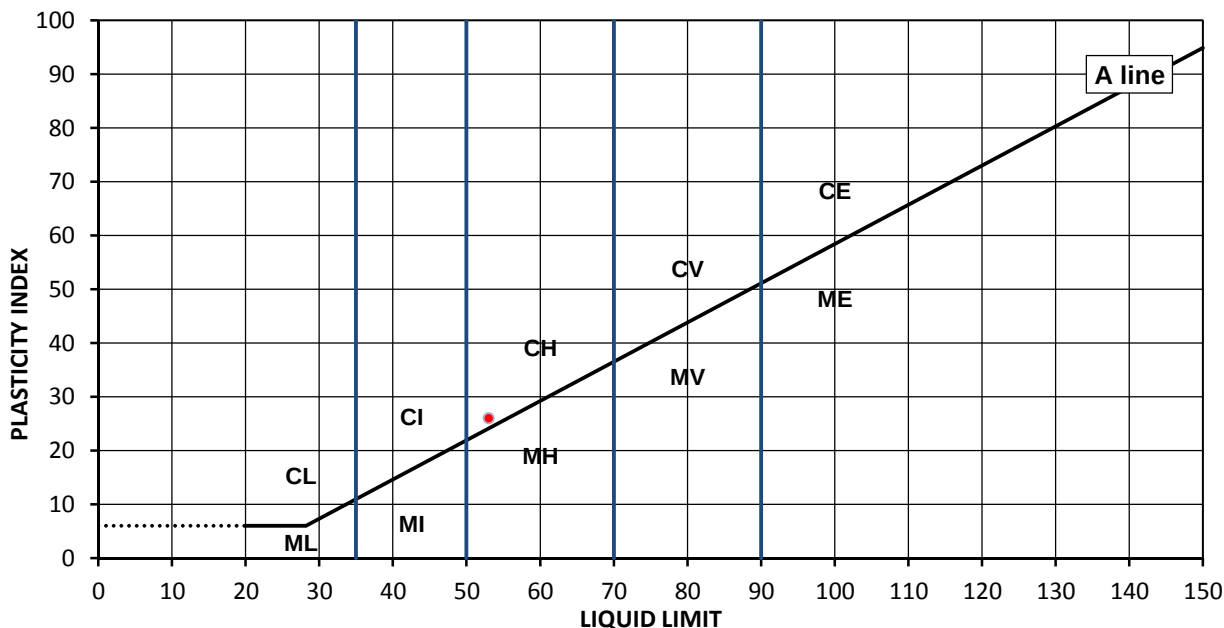
Client Reference: JJ1393
Job Number: 18-99369
Date Sampled: Not Given
Date Received: 03/09/2018
Date Tested: 13/09/2018
Sampled By: Not Given

Test Results

Laboratory Reference: 1040719
Hole No.: WS2
Sample Reference: Not Given
Soil Description: Brown slightly gravelly slightly sandy CLAY
Sample Preparation: Tested after >425um removed by hand

Depth Top [m]: 0.50
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	53	27	26	94



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic		O append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 19/09/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Jomas Associates Ltd
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1 Furzeground Way
Stockley Park
UB11 1BD
Contact: Emma Hucker
Site Name: Bourne Court South Ruislip
Site Address: Bourne Court South Ruislip

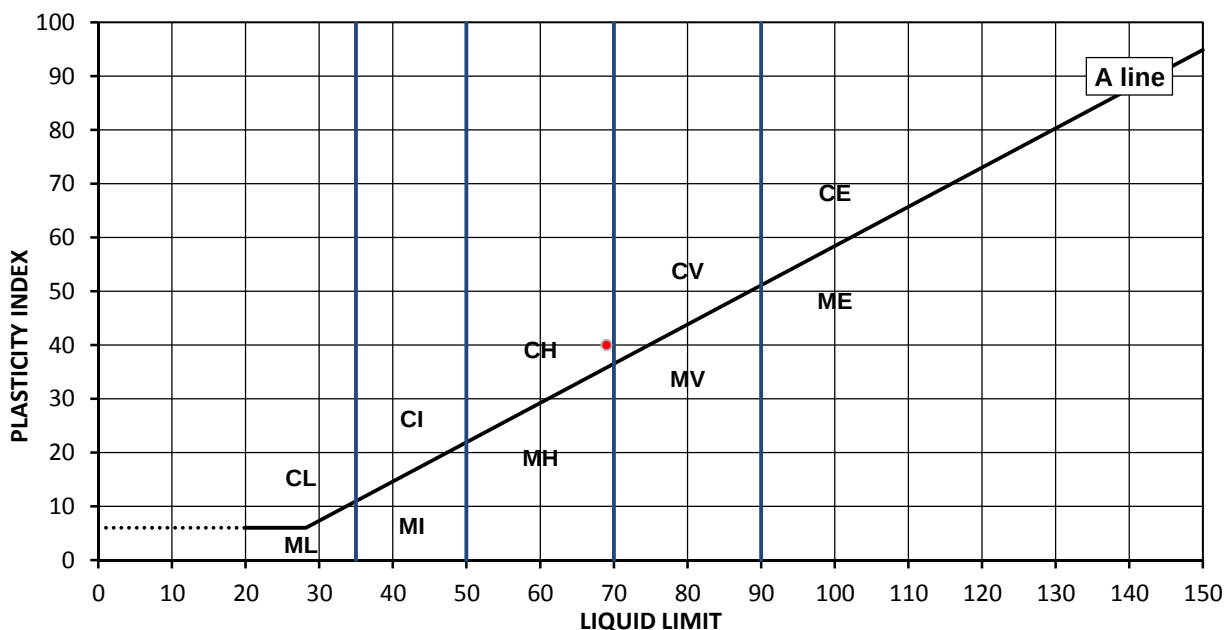
Client Reference: JJ1393
Job Number: 18-99369
Date Sampled: Not Given
Date Received: 03/09/2018
Date Tested: 13/09/2018
Sampled By: Not Given

Test Results

Laboratory Reference: 1040720
Hole No.: WS3
Sample Reference: Not Given
Soil Description: Brown CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 2.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
30	69	29	40	100



Legend, based on BS 5930:2015 Code of practice for site investigations

	Plasticity	Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
	L	Low
	I	Medium
	H	High
	V	Very high
	E	Extremely high
		exceeding 90
Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 19/09/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Jomas Associates Ltd
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UB11 1BD
Contact: Emma Hucker
Site Name: Bourne Court South Ruislip
Site Address: Bourne Court South Ruislip

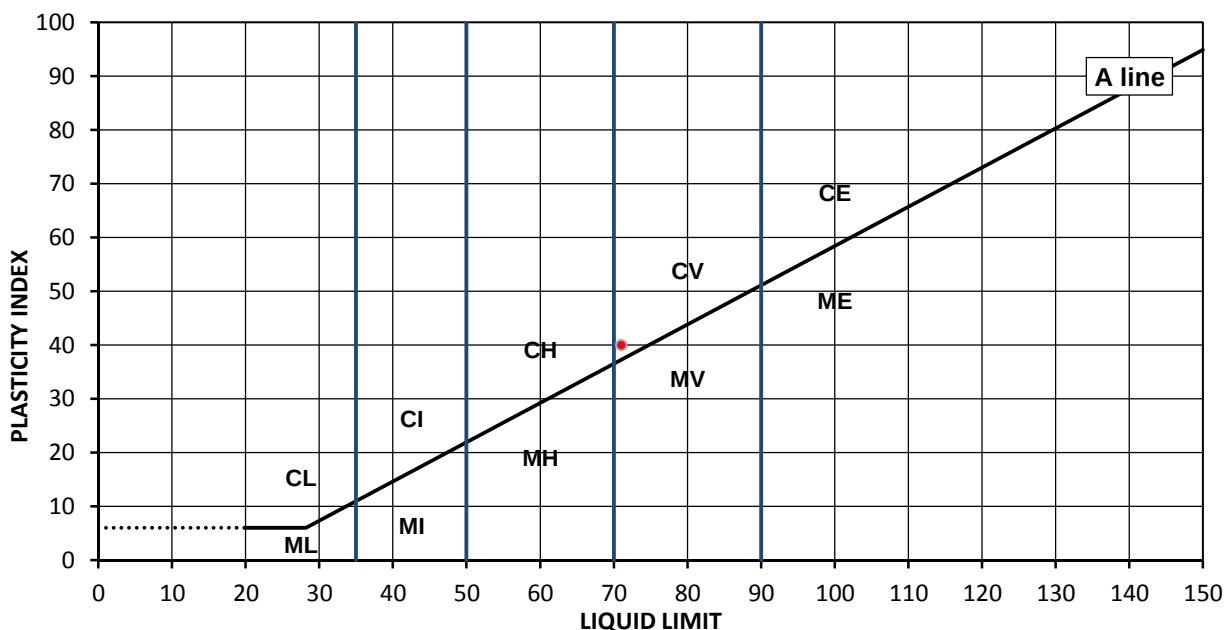
Client Reference: JJ1393
Job Number: 18-99369
Date Sampled: Not Given
Date Received: 03/09/2018
Date Tested: 13/09/2018
Sampled By: Not Given

Test Results

Laboratory Reference: 1040721
Hole No.: WS3
Sample Reference: Not Given
Soil Description: Brown CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 4.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
26	71	31	40	100



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic		O append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 19/09/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



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Contact: Emma Hucker
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Site Address: Bourne Court South Ruislip

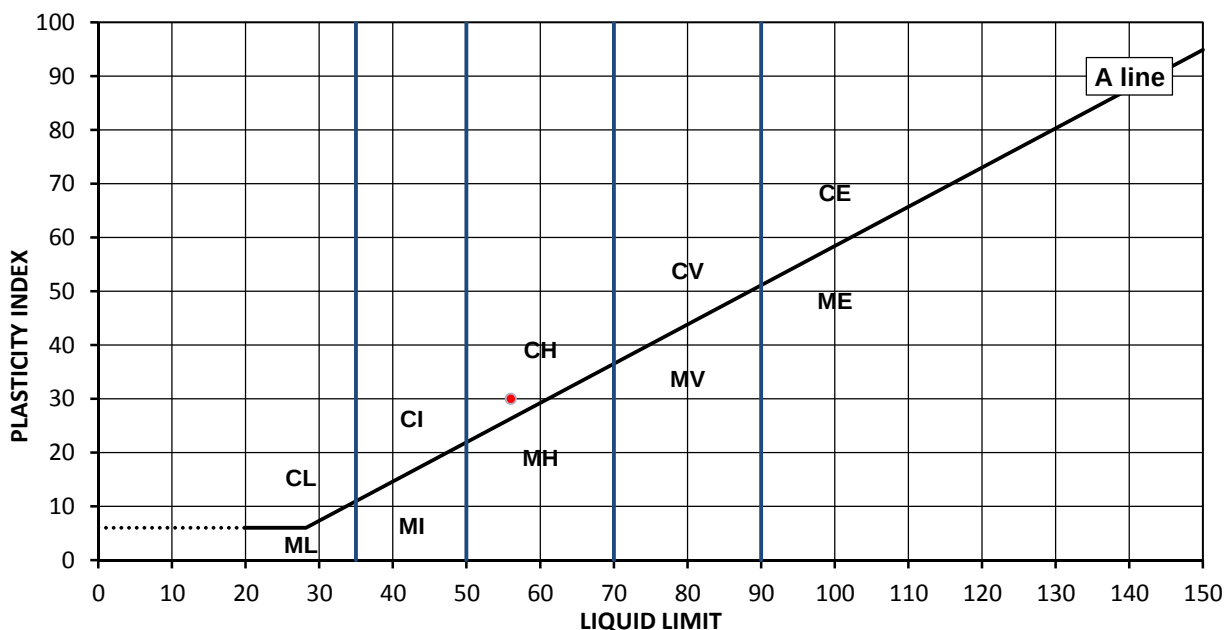
Client Reference: JJ1393
Job Number: 18-99369
Date Sampled: Not Given
Date Received: 03/09/2018
Date Tested: 13/09/2018
Sampled By: Not Given

Test Results

Laboratory Reference: 1040722
Hole No.: WS4
Sample Reference: Not Given
Soil Description: Grey slightly gravelly slightly sandy CLAY
Sample Preparation: Tested after >425um removed by hand

Depth Top [m]: 1.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
29	56	26	30	90



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic		O append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 19/09/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Determination of Liquid and Plastic Limits

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



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UB11 1BD
Contact: Emma Hucker
Site Name: Bourne Court South Ruislip
Site Address: Bourne Court South Ruislip

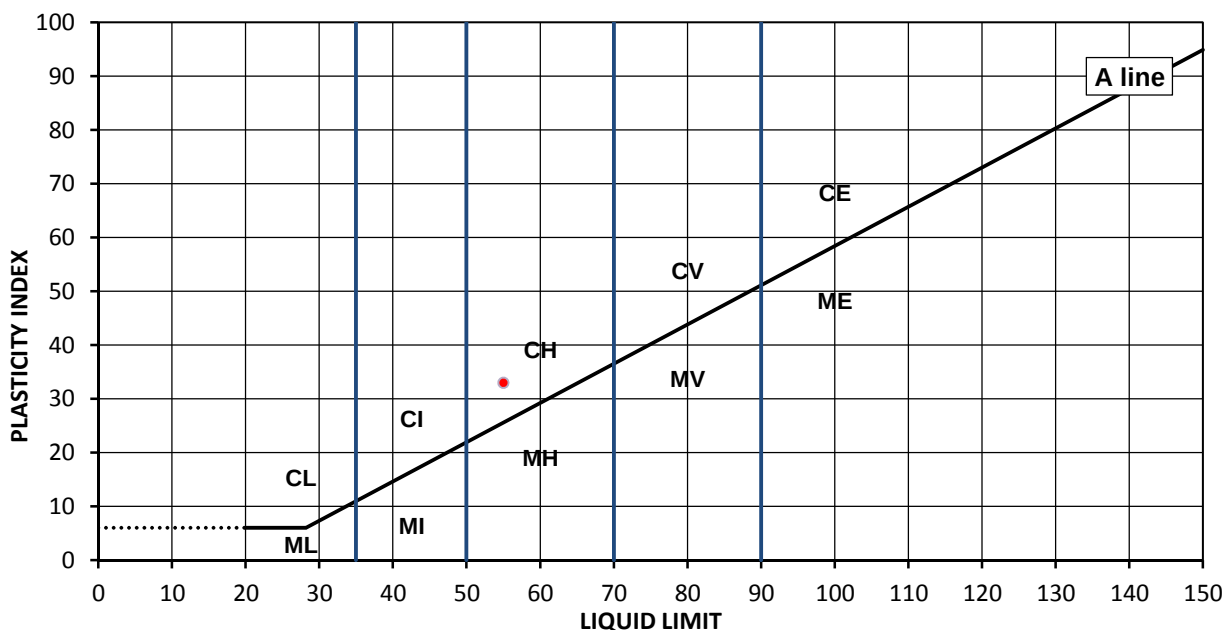
Client Reference: JJ1393
Job Number: 18-99369
Date Sampled: Not Given
Date Received: 03/09/2018
Date Tested: 13/09/2018
Sampled By: Not Given

Test Results

Laboratory Reference: 1040723
Hole No.: WS5
Sample Reference: Not Given
Soil Description: Dark grey slightly gravelly slightly sandy CLAY
Sample Preparation: Tested in natural condition

Depth Top [m]: 5.00
Depth Base [m]: Not Given
Sample Type: D

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
23	55	22	33	100



Legend, based on BS 5930:2015 Code of practice for site investigations

Plasticity		Liquid Limit
C	Clay	below 35
M	Silt	35 to 50
L	Low	50 to 70
I	Medium	70 to 90
H	High	exceeding 90
V	Very high	
E	Extremely high	
Organic		O append to classification for organic material (eg CHO)

Remarks:

Approved:

Dariusz Piotrowski
PL Laboratory
Manager
Date Reported: 19/09/2018

Signed:

Darren Berrill
Geotechnical General
Manager

for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Client: Jomas Associates Ltd
Client Address: Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD
Contact: Emma Hucker
Site Name: Bourne Court South Ruislip
Site Address: Bourne Court South Ruislip

Client Reference: JJ1393
Job Number: 18-99369
Date Sampled: Not Given
Date Received: 03/09/2018
Date Tested: 13/09/2018
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	M/C	Atterberg				Density		Total Porosity
		Reference	Top depth [m]	Base depth [m]	Type			% Passing 425um	LL	PL	PI	bulk	PD	
							%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3
1040717	WS1	Not Given	1.00	Not Given	D	Brown slightly clayey GRAVEL	9.8							
1040718	WS1	Not Given	3.00	Not Given	D	Yellowish brown CLAY	28	100	64	27	37			
1040719	WS2	Not Given	0.50	Not Given	D	Brown slightly gravelly slightly sandy CLAY	24	94	53	27	26			
1040720	WS3	Not Given	2.00	Not Given	D	Brown CLAY	30	100	69	29	40			
1040721	WS3	Not Given	4.00	Not Given	D	Brown CLAY	26	100	71	31	40			
1040722	WS4	Not Given	1.00	Not Given	D	Grey slightly gravelly slightly sandy CLAY	29	90	56	26	30			
1040723	WS5	Not Given	5.00	Not Given	D	Dark grey slightly gravelly slightly sandy CLAY	23	100	55	22	33			

Comments:

Approved:

Dariusz Piotrowski
PL Laboratory Manager
Geotechnical Section

Date Reported: 19/09/2018

Signed:

Darren Berrill
Geotechnical General Manager

for and on behalf of i2 Analytical Ltd

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APPENDIX 5 – SOIL GAS MONITORING TEST RESULTS

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET														
Site: Bourne Court		Operative(s): CLP		Date: 06/09/2018		Time: 09:05		Round: 1		Page: 1				
MONITORING EQUIPMENT														
Instrument Type		Instrument Make				Serial No.				Date Last Calibrated				
Analox		GA5000								10/01/2018				
PID		Phocheck tiger								20/05/2016				
Dip Meter		GeoTech												
MONITORING CONDITIONS														
Weather Conditions: Sunny				Ground Conditions: Dry				Temperature: 14°C						
Barometric Pressure (mbar): 1014				Barometric Pressure Trend (24hr): Falling				Ambient Concentration: 0.1%CH ₄ , 0.1%CO ₂ , 21.3%O ₂						
MONITORING RESULTS														
Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	CH ₄ %	CH ₄ % LEL	CO ₂ %	O ₂ %	VOC (ppm)		H ₂ S (ppm)	CO (ppm)	Depth to product (mbgl)	Depth to water (mbgl)	Depth to Base of well (mbgl)
	Peak	Steady						Peak	Steady					
WS1	+0.1	+0.1	1014	0.1	/	3.2	18.9	0.7	0.7	0	0	/	2.95	3.85
WS3	+0.1	+0.1	1015	0.1	/	0.4	21.1	0.5	0.5	0	0	/	3.11	3.79
WS4	0.0	0.0	1015	0.1	/	0.5	20.8	0.4	0.4	0	0	/	2.10	3.89
					/							/		
					/							/		
					/							/		
					/							/		

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET														
Site: Bourne Court		Operative(s): CLP		Date: 17/09/2018		Time: 09:20		Round: 2		Page: 1				
MONITORING EQUIPMENT														
Instrument Type		Instrument Make				Serial No.			Date Last Calibrated					
Analox		GA5000							10/01/2018					
PID		Phocheck tiger							20/05/2016					
Dip Meter		GeoTech												
MONITORING CONDITIONS														
Weather Conditions: Overcast				Ground Conditions: Dry				Temperature: 14°C						
Barometric Pressure (mbar): 1014				Barometric Pressure Trend (24hr): Falling				Ambient Concentration: 0.2%CH ₄ , 0.1%CO ₂ , 21.0%O ₂						
MONITORING RESULTS														
Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	CH ₄ %	CH ₄ % LEL	CO ₂ %	O ₂ %	VOC (ppm)		H ₂ S (ppm)	CO (ppm)	Depth to product (mbgl)	Depth to water (mbgl)	Depth to Base of well (mbgl)
	Peak	Steady						Peak	Steady					
WS1	+0.1	+0.1	1014	0.2	/	0.5	21.0	0.3	0.2	0	0	/	2.12	3.85
WS3	+0.2	+0.2	1014	0.1	/	0.1	20.9	0.2	0.2	0	0	/	2.23	3.80
WS4	0.0	0.0	1014	0.2	/	0.4	20.9	0.3	0.3	0	0	/	1.70	3.86
					/							/		
					/							/		
					/							/		
					/							/		

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET														
Site: Bourne Court		Operative(s): CLP		Date: 21/09/2018		Time: 13:40		Round: 3		Page: 1				
MONITORING EQUIPMENT														
Instrument Type		Instrument Make				Serial No.			Date Last Calibrated					
Analox		GA5000							10/01/2018					
PID		Phocheck tiger							20/05/2016					
Dip Meter		GeoTech												
MONITORING CONDITIONS														
Weather Conditions: Raining				Ground Conditions: Damp				Temperature: 14°C						
Barometric Pressure (mbar): 1014				Barometric Pressure Trend (24hr): Falling				Ambient Concentration: 0.2%CH ₄ , 0.1%CO ₂ , 21.0%O ₂						
MONITORING RESULTS														
Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	CH ₄ %	CH ₄ % LEL	CO ₂ %	O ₂ %	VOC (ppm)		H ₂ S (ppm)	CO (ppm)	Depth to product (mbgl)	Depth to water (mbgl)	Depth to Base of well (mbgl)
	Peak	Steady						Peak	Steady					
WS1	+0.2	+0.2	1007	0.2	/	0.1	21.2	0	0	0	0	/	1.88	3.85
WS3	+0.1	+0.1	1008	0.2	/	0.1	21.2	0	0	0	0	/	2.05	3.79
WS4	0.1	0.1	1008	0.2	/	0.1	21.2	0	0	0	0	/	1.61	3.88
					/							/		
					/							/		
					/							/		
					/							/		

GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET														
Site: Bourne Court		Operative(s): JLW		Date: 26/09/2018		Time: 12:38		Round: 4		Page: 1				
MONITORING EQUIPMENT														
Instrument Type		Instrument Make				Serial No.				Date Last Calibrated				
Analox		GA5000								10/01/2018				
PID		Phocheck tiger								20/05/2016				
Dip Meter		GeoTech												
MONITORING CONDITIONS														
Weather Conditions: Sunny				Ground Conditions: Dry				Temperature: 18°C						
Barometric Pressure (mbar): 1029				Barometric Pressure Trend (24hr): Steady				Ambient Concentration: 0.2%CH ₄ , 0.1%CO ₂ , 21.1%O ₂						
MONITORING RESULTS														
Monitoring Point Location	Flow		Atmospheric Pressure (mbar)	CH ₄ %	CH ₄ % LEL	CO ₂ %	O ₂ %	VOC (ppm)		H ₂ S (ppm)	CO (ppm)	Depth to product (mbgl)	Depth to water (mbgl)	Depth to Base of well (mbgl)
	Peak	Steady						Peak	Steady					
WS1	0.0	0.0	1030	0.1	/	3.5	16.1	0.2	0.2	0	0	/	1.62	3.84
WS3	+0.1	+0.1	1030	0.1	/	0.3	20.6	0.2	0.2	0	0	/	1.89	3.79
WS4	+0.2	+0.2	1029	0.1	/	0.8	20.5	0.2	0.2	0	0	/	1.68	3.84
					/							/		
					/							/		
					/							/		
					/							/		

APPENDIX 6 – CBR ANALYTICAL RESULTS

CBR Calculation



Jomas Job: Bourne Court, South Ruislip, HA4 6SW
Jomas Job No.: P1528J1393

Test Location: CBR1
Date of test: 30/08/2018

Depth (mm)	Nr Blow	Cumulative blows
50	3	3
100	2	5
150	2	7
200	1	8
250	1	9
300	0	9
350	1	10
400	0	10
450	1	11
500	0	11
550	1	12
600	0	12
650	0	12
700	1	13
750	0	13
800	0	13
850	1	14
900	0	14
950	5	19
1000	5	24

Calculating Engineer: AJH
Approved by: PS

Date: 31/08/2018
Date: 04/10/2018

Test	Initial Depth (mm)	Final Depth (mm)	mm / blow	CBR* (%)	E (MPa)
CBR1-Test 1	50	250	33.3	7.4	63.36
CBR1-Test 2	250	900	130.0	1.8	25.64
CBR1-Test 3	900	1000	10.0	26.5	143.35
CBR1-Test 4	50	1000	45.2	5.4	51.79

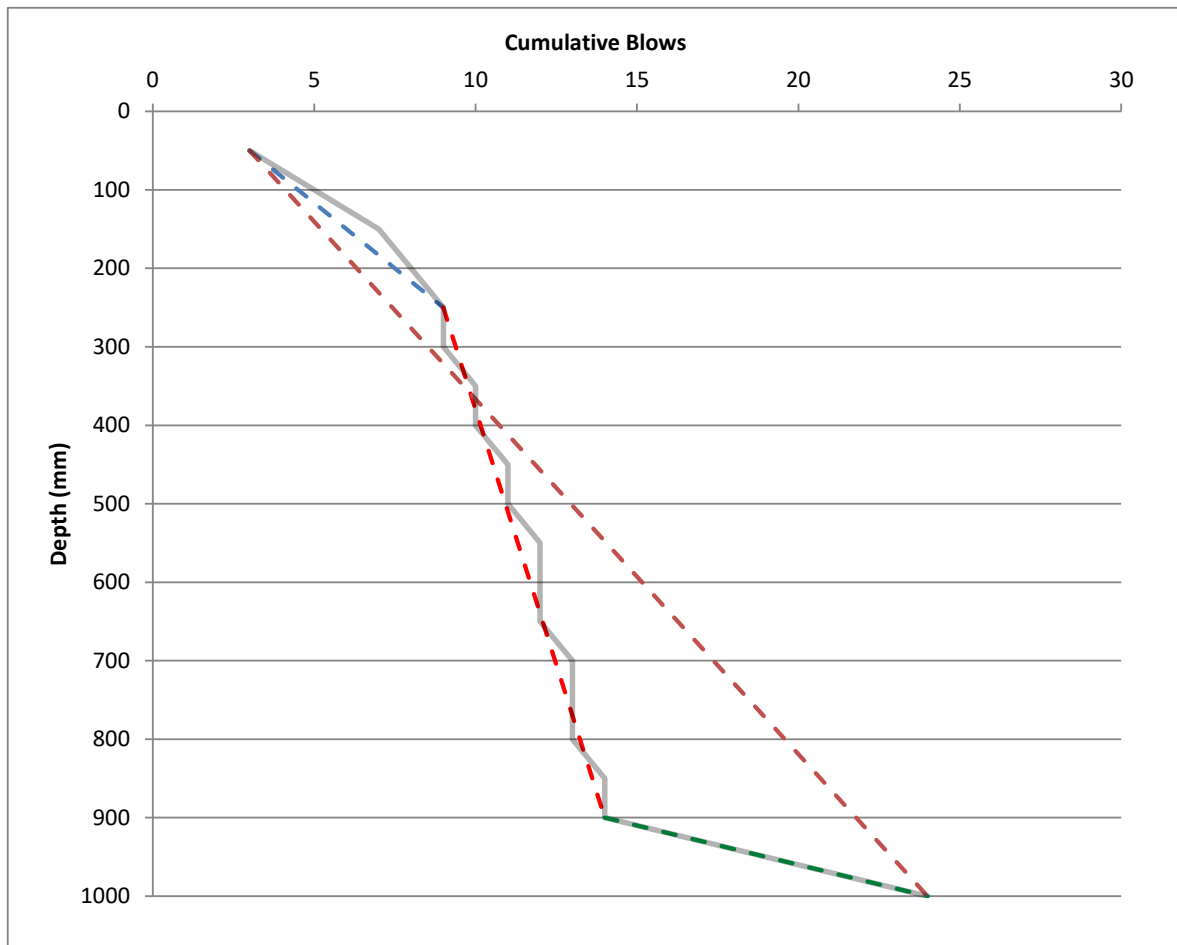
* CBR calculated using method outlined in IAN 73/06

Test Notes:

Test carried out using a Perth Probe type dynamic cone probe consisting of a 8 kg free fall hammer lifted and dropped through a height of 575mm

Colour of text refers to the modelled gradient on graph below

Black and grey clayey sand with frequent brick. (MADE GROUND)



CBR Calculation



Jomas Job: Bourne Court, South Ruislip, HA4 6SW
Jomas Job No.: P1528J1393

Test Location: CBR2
Date of test: 30/08/2018

Depth (mm)	Nr Blow	Cumulative blows
50	2	2
100	3	5
150	1	6
200	1	7
250	1	8
300	0	8
350	1	9
400	0	9
450	1	10
500	0	10
550	1	11
600	0	11
650	0	11
700	1	12
750	0	12
800	1	13
850	0	13
900	1	14
950	0	14
1000	1	15

Calculating Engineer: AJH
Approved by: PS

Date: 31/08/2018
Date: 04/10/2018

Test	Initial Depth (mm)	Final Depth (mm)	mm / blow	CBR* (%)	E (MPa)
CBR2-Test 1	50	100	16.7	15.4	101.28
CBR2-Test 2	100	550	75.0	3.1	36.31
CBR2-Test 3	550	1000	112.5	2.1	28.3

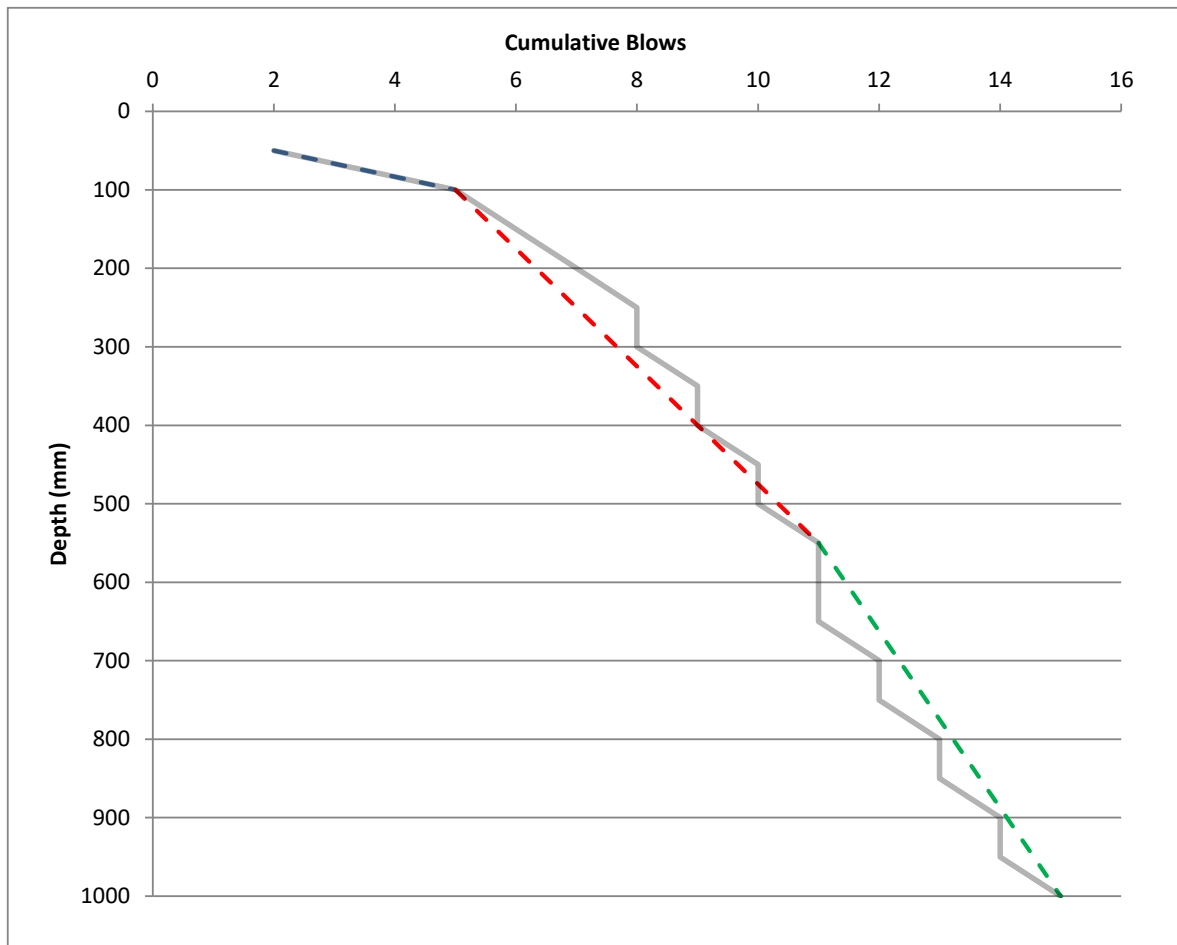
* CBR calculated using method outlined in IAN 73/06

Test Notes:

Test carried out using a Perth Probe type dynamic cone probe consisting of a 8 kg free fall hammer lifted and dropped through a height of 575mm

Colour of text refers to the modelled gradient on graph below

Black and grey clayey sand with frequent brick. (MADE GROUND)



CBR Calculation



Specialists in the investigation & reclamation of brownfield sites

Jomas Job: Bourne Court, South Ruislip, HA4 6SW
Jomas Job No.: P1528J1393

Test Location: CBR3
Date of test: 30/08/2018

Depth (mm) **Nr Blow** **Cumulative blows**

Calculating Engineer: AJH
Approved by: PS

Date: 31/08/2018

Date: 04/10/2018

50	4	4
100	3	7
150	2	9
200	2	11
250	2	13
300	2	15
350	2	17
400	3	20
450	4	24
500	3	27
550	2	29
600	2	31
650	1	32
700	1	33
750	1	34
800	1	35
850	1	36
900	1	37
950	1	38
1000	1	39

Test	Initial Depth (mm)	Final Depth (mm)	mm / blow	CBR* (%)	E (MPa)
CBR3-Test 1	50	350	23.1	10.9	81.18
CBR3-Test 2	350	600	17.9	14.3	96.59
CBR3-Test 3	600	1000	50.0	4.8	48.03
CBR3-Test 4	50	1000	27.1	9.2	72.83

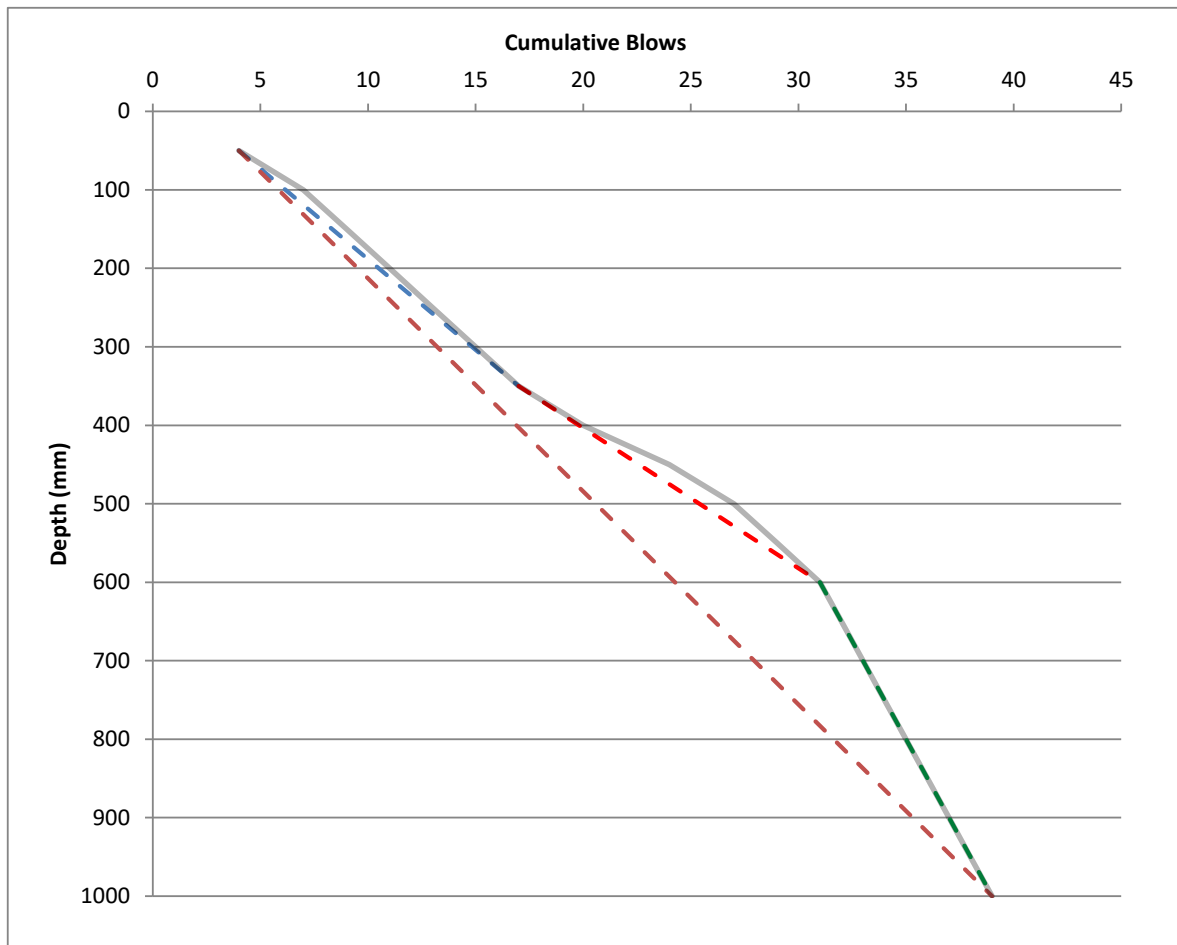
* CBR calculated using method outlined in IAN 73/06

Test Notes:

Test carried out using a Perth Probe type dynamic cone probe consisting of a 8 kg free fall hammer lifted and dropped through a height of 575mm

Colour of text refers to the modelled gradient on graph below

Black and grey clayey sand with frequent brick. (MADE GROUND)



CBR Calculation



Specialists in the investigation & reclamation of brownfield sites

Jomas Job: Bourne Court, South Ruislip, HA4 6SW
Jomas Job No.: P1528J1393

Test Location: CBR4
Date of test: 30/08/2018

Depth (mm)	Nr Blow	Cumulative blows
50	1	1
100	5	6
150	10	16
200	6	22
250	10	32
300	8	40
350	6	46
400	9	55
450	6	61
500	6	67
550	5	72
600	5	77
650	4	81
700	4	85
750	3	88
800	2	90
850	2	92
900	1	93
950	2	95
1000	1	96

Calculating Engineer: AJH
Approved by: PS

Date: 31/08/2018
Date: 04/10/2018

Test	Initial Depth (mm)	Final Depth (mm)	mm / blow	CBR* (%)	E (MPa)
CBR4-Test 1	50	400	6.5	41.9	192.19
CBR4-Test 2	400	700	10.0	26.5	143.35
CBR4-Test 3	700	1000	27.3	9.2	72.83
CBR4-Test 4	50	1000	10.0	26.5	143.35

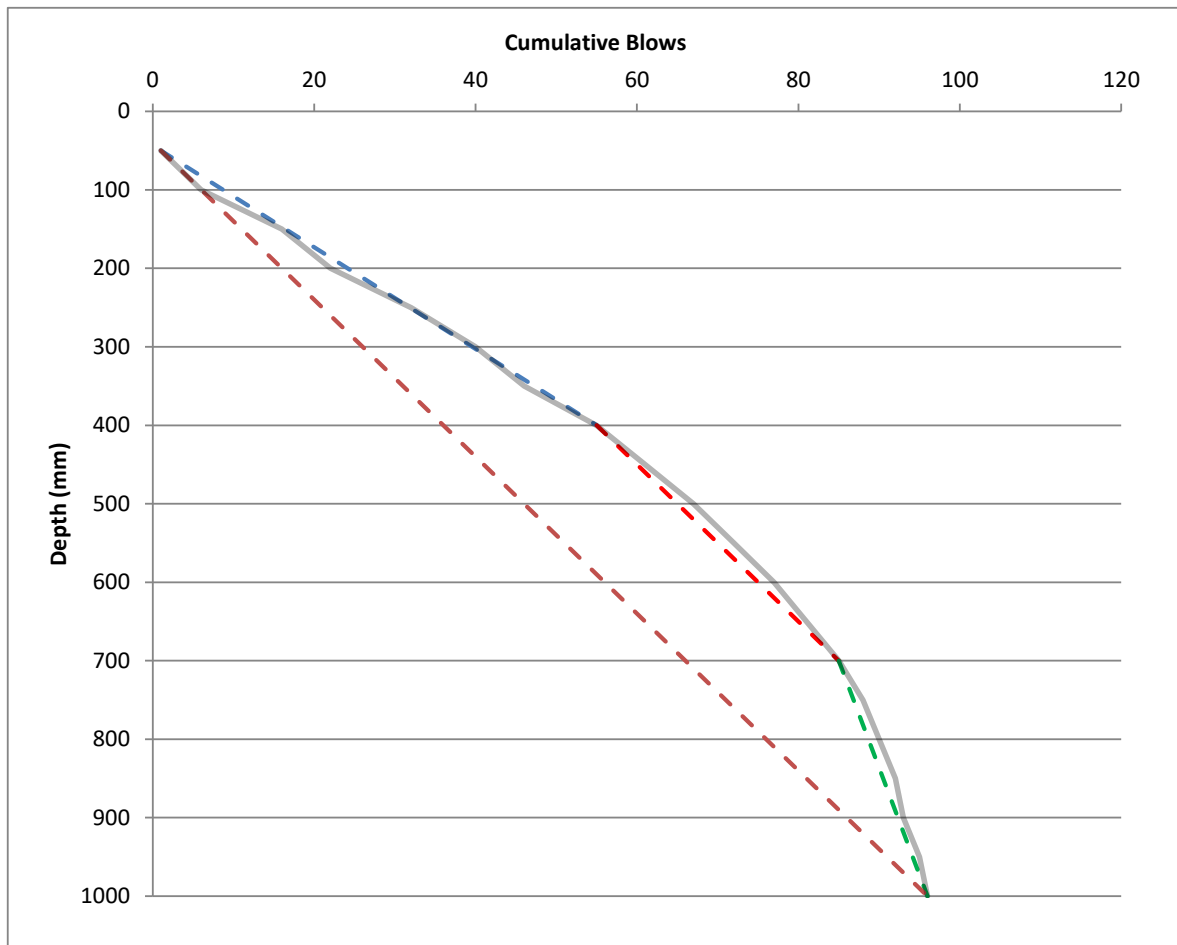
* CBR calculated using method outlined in IAN 73/06

Test Notes:

Test carried out using a Perth Probe type dynamic cone probe consisting of a 8 kg free fall hammer lifted and dropped through a height of 575mm

Colour of text refers to the modelled gradient on graph below

Black and grey clayey sand with frequent brick. (MADE GROUND)



CBR Calculation



Jomas Job: Bourne Court, South Ruislip, HA4 6SW
Jomas Job No.: P1528J1393

Test Location: CBR5
Date of test: 30/08/2018

Depth (mm)	Nr Blow	Cumulative blows
50	6	6
100	9	15
150	9	24
200	2	26
250	1	27
300	1	28
350	0	28
400	1	29
450	1	30
500	0	30
550	1	31
600	0	31
650	1	32
700	1	33
750	2	35
800	1	36
850	4	40
900	6	46
950	9	55
1000	6	61

Calculating Engineer: AJH
Approved by: PS

Date: 31/08/2018
Date: 04/10/2018

Test	Initial Depth (mm)	Final Depth (mm)	mm / blow	CBR* (%)	E (MPa)
CBR2-Test 1	50	150	5.6	49.3	213.27
CBR2-Test 2	150	800	54.2	4.4	45.43
CBR2-Test 3	800	1000	8.0	33.5	166.55
CBR5-Test 4	50	1000	17.3	14.9	99.16

* CBR calculated using method outlined in IAN 73/06

Test Notes:

Test carried out using a Perth Probe type dynamic cone probe consisting of a 8 kg free fall hammer lifted and dropped through a height of 575mm

Colour of text refers to the modelled gradient on graph below

Black and grey clayey sand with frequent brick. (MADE GROUND)

